Minidex

YANMAR®

TNV series

OPERATION MANUAL

3TNV82A
3TNV84 • 3TNV84T • 3TNV88
4TNV84 • 4TNV84T • 4TNV88
4TNV94L
4TNV98 • 4TNV98T
4TNV106 • 4TNV106T

P/N: 0ATNV0-U0000

INDUSTRIAL ENGINES

Disclaimers:

We reserve the right to change specifications and to improve our products without notice or obligation.

Yanmar and YANMAR are registered trademarks of Yanmar Co., Ltd. in Japan, the United States and / or other countries.

THIS MANUAL IS AVAILABLE IN OTHER LANGUAGES

If you would like a copy of this manual in the English language, please contact your local authorized Yanmar industrial engine dealer or distributor. A list of authorized Yanmar industrial engine dealers and distributors can be found at:

http://www.yanmar.co.jp/english/index-network.htm

PLEASE NOTE THAT THIS STATEMENT IS BEING TRANSLATED INTO THE FOLLOWING LANGUAGES AND WILL BE PLACED AS SOON AS THE TRANSLATIONS ARE COMPLETE

Arabic

Chinese

Czech

Danish

Dutch

ISO French

Finnish

German

Greek

Hungarian

Italian

Japanese

Norwegian

Polish

Portuguese

Russian

Slovakian

ISO Spanish

Swedish

Turkish

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INTRODUCTION

Welcome to the world of Yanmar Engines! Yanmar has been the leader in industrial diesel engines for over 90 years. We developed the world's first practical small-sized diesel engine in 1933. Our engineers are continuously developing new technology to keep Yanmar on the leading-edge of the industry. The TNV engine is only one example of the new technology we have developed. We are committed to maintaining our environment, and are proud of our history of innovation, quality and respect for operator safety.

To help you enjoy your Yanmar TNV engine for many years to come, please follow these recommendations:

- Read and understand this Operation Manual before you operate the machine to ensure that you follow safe operating practices and maintenance procedures.
- Keep this Operation Manual in a convenient place for easy access.
- If this Operation Manual is lost or damaged, order a new one from your authorized Yanmar industrial engine dealer or distributor.
- Make sure this manual is transferred to subsequent owners. This manual should be considered a permanent part of the engine and remain with it.
- Constant efforts are made to improve the quality and performance of Yanmar products, so some details included in this Operation Manual may differ slightly from your engine. If you have any questions about these differences, please contact your authorized Yanmar industrial engine dealer or distributor.
- The specifications and components (instrument panel, fuel tank, etc.) described in this manual may differ from ones installed on your machine. Please refer to the manual provided by the manufacturer of these components.

RECORD OF OWNERSHIP

Take a few moments to record the information you need when you contact Yanmar for service, parts or literature.

Engine Model: _____

Engine Serial No.: _____

Date Purchased: _____

Dealer: _____

Dealer Phone: _____

YANMAR WARRANTIES

YANMAR LIMITED WARRANTY

What is Covered by this Warranty?

Yanmar warrants to the original retail purchaser that your new Yanmar TNV Series Industrial Engine will be free from defects in material and / or workmanship for the duration of the warranty period.

How Long is the Warranty Period?

The Yanmar standard limited warranty period begins on the date of the delivery of the new Yanmar TNV Series Industrial Engine to the first retail purchaser and extends for a period of **twenty-four (24) months or two-thousand (2000) engine operation hours**, whichever occurs first. An extended warranty is provided for these specific parts: The cylinder block, cylinder head, crankshaft, connecting rods, flywheel, flywheel housing, camshaft, timing gear, and gear case. These listed parts are warranted for a period, also beginning with the date of the delivery of the new Yanmar engine to the first retail purchaser, of **thirty-six (36) months or three-thousand (3000) engine operation hours** whichever occurs first.

What the Engine Owner Must Do:

If you believe your Yanmar engine has experienced a failure due to a defect in material and / or workmanship, you must contact an authorized Yanmar industrial engine dealer or distributor within thirty (30) days of discovering the failure. You must provide proof of ownership of the engine, proof of the date of the engine purchase and delivery, and documentation of the engine operation hours. You are responsible for the transportation of the engine to and from the repair location as designated by Yanmar.

Yanmar strongly recommends you register your engine as soon as possible after purchase in order to facilitate any future warranty matters.

Yanmar Limited Warranty - Continued

To Locate an Authorized Yanmar Industrial Engine Dealer or Distributor:

You can locate your nearest authorized Yanmar industrial engine dealer or distributor by visiting the Yanmar Corp., LTD. website at:

http://www.yanmar.co.jp (The Japanese page will be displayed. For English, click on "English Page."

- Click on "Network" to view "Yanmar Worldwide Distribution Network."
- Click on "Sales Network."
- Click on the country. Click on "Go" to view the list of authorized Yanmar industrial engine dealers or distributors.
- Select the authorized Yanmar industrial engine dealer or distributor nearest your location. Note: "Land" denotes an industrial dealer or distributor.
- You may also contact Yanmar by clicking on "Inquiry" on the Yanmar Japan home page.

What Yanmar Will Do:

Yanmar warrants to the original retail purchaser of a new Yanmar engine that Yanmar will make such repairs and / or replacements necessary to correct any defects in materials and / or workmanship discovered during the warranty period. Such repairs and / or replacements will be made at a location designated by Yanmar.

What is Not Covered by this Warranty?

This Warranty does not cover parts affected by or damaged by, but not limited to, accident, misuse, abuse, "Acts of God," neglect, improper installation, improper maintenance, improper storage, the use of unsuitable attachments or parts, the use of contaminated fuels, the use of fuels, oils, lubricants, or fluids other than those recommended in your Yanmar Operation Manual, unauthorized alterations or modifications, ordinary wear and tear, and rust or corrosion. This Warranty does not cover the cost of parts and / or labor required to perform normal / scheduled maintenance on your Yanmar engine. This Warranty does not cover consumable parts such as, but not limited to, filters, belts, hoses, fuel injector nozzles, lubricants and cleaning fluids.

Warranty Limitations:

The foregoing is Yanmar's only obligation to you and your exclusive remedy for breach of warranty. Failure to follow the requirements for submitting a claim under this Warranty may result in a waiver of all claims for damages and other relief. **In no event shall Yanmar or any authorized industrial engine dealer or distributor be liable for incidental, special or consequential damages.** Such consequential damages may include, but not be limited to, loss of revenue, loan payments, cost of rental of substitute equipment, insurance coverage, storage, lodging, transportation, fuel, mileage, and telephone costs. The limitations in this Warranty apply regardless of whether your claims are based on breach of contract, tort (including negligence and strict liability) or any other theory. Any action arising hereunder must be brought within one (1) year after the cause of action accrues or it shall be barred. Some states and countries do not allow certain limitations on warranties or for breach of warranties. **This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state and country to country.** Limitations set forth in this paragraph shall not apply to the extent that they are prohibited by law.

Yanmar Limited Warranty - Continued

Warranty Modifications:

Except as modified in writing and signed by the parties, this Warranty is and shall remain the complete and exclusive agreement between the parties with respect to warranties, superseding all prior agreements, written and oral, and all other communications between the parties relating to warranties. **No person or entity is authorized to give any other warranty or to assume any other obligation on behalf of Yanmar, either orally or in writing.**

Questions:

If you have any questions or concerns regarding this Warranty, please call or write to the nearest authorized Yanmar industrial engine dealer or distributor or other authorized facility.

Customer Registration

Customer registration is very important for the original retail purchaser to enable Yanmar to provide the best support for your engine.

At the time of purchase, Yanmar highly recommends registering the customer's information through website http://www.yanmar.co.jp as soon as possible.

If it is not possible to access the website, please contact the nearest authorized Yanmar industrial engine dealer or distributor.

YANMAR CO., LTD. LIMITED EMISSION CONTROL SYSTEM WARRANTY - USA ONLY

Your Warranty Rights and Obligations:

California

The California Air Resources Board and Yanmar Co., Ltd. ("Yanmar") is pleased to explain the emission control system warranty on your off-road compression-ignition model year 2000 or later engine. In California, new heavy-duty off-road engines must be designed, built and equipped to meet the State's stringent anti-smog standards.

All States

Yanmar warrants that the engine is: (1) designed, built and equipped so as to conform with all applicable emissions regulations, including in California, all applicable regulations adopted by the Air Resources Board; and (2) free from defects in materials and workmanship which cause such engine to fail to conform with applicable emissions regulations for its warranty period.

Yanmar warrants the emission control system on your engine for the periods of time listed in the following table provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the fuel injection system and the air induction system. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Yanmar will repair your heavy-duty off-road engine at no charge to you for diagnosis, parts or labor. Warranty services or repairs will be provided at an authorized Yanmar industrial engine dealer or distributor.

Manufacturer's Warranty Period:

The emission related parts on your model year 2000 or later heavy-duty off-road engines are warranted for the periods listed below. If any emission-related part on your engine is found to be defective during the applicable warranty period, the part will be replaced by Yanmar.

Engine Type	Warranty Period by Number of Years or Hours of Operation
Engines rated at or above 25.5 hp SAE (19 kW)	Warranty period is five (5) years or 3,000 hours of use, whichever occurs first. In the absence of a device to measure hours of use, the engine has a warranty period of five (5) years.
Engines rated under 25.5 hp SAE (19 kW)	Warranty period is two (2) years or 1,500 hours of use, whichever occurs first. In the absence of a device to measure hours of use, the engine has a warranty period of two (2) years.
Constant speed engines rated under 50 hp SAE (37 kW) with rated speeds greater than or equal to 3,000 rpm	Warranty period is two (2) years or 1,500 hours of use, whichever occurs first. In the absence of a device to measure hours of use, the engine has a warranty period of five (5) years.
Constant speed engines rated at or above 50 hp SAE (37 kW)	Warranty period is five (5) years or 3,000 hours of use, whichever occurs first. In the absence of a device to measure hours of use, the engine has a warranty period of five (5) years.

Limited Emission Control System Warranty - USA Only - Continued

Warranty Coverage:

This warranty is transferable to each subsequent purchaser for the duration of the warranty period. Repair or replacement of any warranted part will be performed at an authorized Yanmar industrial engine dealer or distributor.

Warranted parts not scheduled for replacement as required maintenance in the Operation Manual shall be warranted for the warranty period. Warranted parts scheduled for replacement as required maintenance in the Operation Manual are warranted for the period of time prior to the first scheduled replacement. Any part repaired or replaced under warranty shall be warranted for the remaining warranty period.

During the warranty period, Yanmar is liable for damages to other engine components caused by the failure of any warranted part during the warranty period.

Any replacement part which is functionally identical to the original equipment part in all respects may be used in the maintenance or repair of your engine, and shall not reduce Yanmar's warranty obligations. Add-on or modified parts that are not exempted may not be used. The use of any non-exempted add-on or modified parts shall be grounds for disallowing a warranty.

Warranted Systems / Parts Covered by this Warranty:

This warranty covers engine components that are a part of the emission control system of the engine as delivered by Yanmar to the original retail purchaser. Such components may include the following:

- Fuel Injection System
- Cold Start Enrichment System
- Intake Manifold
- Turbocharger Systems
- Exhaust Manifold
- Positive Crankshaft Ventilation (PCV) System
- PCV Valve
- Oil Filler Cap

Limited Emission Control System Warranty - USA Only - Continued

Exclusions:

Failures other than those arising from defects in material or workmanship are not covered by this warranty. The warranty does not extend to the following: malfunctions caused by abuse, misuse, improper adjustment, modification, alteration, tampering, disconnection, improper or inadequate maintenance, improper storage, or use of non-recommended fuels and lubricating oils; accident-caused damage, and replacement of expendable (and / or consumable) items made in connection with scheduled maintenance. Yanmar disclaims any responsibility for incidental or consequential damages such as loss of time, inconvenience, loss of use of equipment / engine or commercial loss.

Owner's Warranty Responsibilities:

As the heavy-duty off-road engine owner, you are responsible for the performance of the required maintenance listed in your Operation Manual. Yanmar recommends that you retain all documentation, including receipts, covering maintenance on your heavy-duty off-road engine, but Yanmar cannot deny warranty solely for the lack of receipts, or for your failure to ensure the performance of all scheduled maintenance.

Your engine is designed to operate on diesel fuel only. Use of any other fuel may result in your engine no longer operating in compliance with applicable emissions requirements.

You are responsible for initiating the warranty process. You must present your off-road engine to an authorized Yanmar industrial engine dealer or distributor as soon as a problem exists. The warranty repairs should be completed by the dealer or distributor as expeditiously as possible. If you have any questions regarding your warranty rights and responsibilities, or would like information on the nearest authorized Yanmar industrial engine dealer or distributor, you should contact Yanmar America Corp. at 1-800-872-2867.

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SAFETY

SAFETY STATEMENTS

Yanmar is concerned for your safety and your machine's condition. Safety statements are one of the primary ways to call your attention to the potential hazards associated with Yanmar TNV engine operation. Follow the precautions listed throughout the manual before operation, during operation and during periodic maintenance procedures for your safety, the safety of others and to protect the performance of your engine. Keep the labels from becoming dirty or torn and replace them if they are lost or damaged. Also, if you need to replace a part that has a label attached to it, make sure you order the new part and label at the same time.

This safety alert symbol appears with most safety statements. It means attention, become alert, your safety is involved! Please read and abide by the message that follows the safety alert symbol.

⚠ DANGER

Danger (the word "DANGER" is in white letters with a red rectangle behind it) – indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Danger is limited to the most extreme situations.

⚠ WARNING

Warning (the word "WARNING" is in black letters with an orange rectangle behind it) – indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Caution (the word "CAUTION" is in black letters with a yellow rectangle behind it) – indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION

Caution *without the safety alert symbol* indicates a potentially hazardous situation that can cause damage to the machine, personal property and / or the environment or cause the machine to operate improperly.

SAFETY PRECAUTIONS

Before You Operate

CAUTION

NEVER permit anyone to operate the engine or driven machine without proper training.

- Read and understand this Operation Manual before you operate the machine to ensure that you follow safe operating practices and maintenance procedures.
- Machine safety signs and labels are additional reminders for safe operating and maintenance techniques.
- See your authorized Yanmar industrial engine dealer or distributor for additional training.

During Operation and Maintenance

⚠ DANGER

SCALD HAZARD!

- NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.
- Securely tighten the radiator cap after you check the radiator. Steam can spurt out during engine operation if the cap is loose.
- ALWAYS check the level of engine coolant by observing the reserve tank.
- Failure to comply will result in death or serious injury.

⚠ DANGER

EXPLOSION HAZARD!

- Keep the area around the battery well ventilated. While the engine is running or the battery is charging, hydrogen gas is produced which can be easily ignited.
- Keep sparks, open flame and any other form of ignition away.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.
- NEVER use a shop rag to catch the fuel. Vapors from the rag are extremely flammable and explosive.
- Wipe up any spills immediately.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Only use the key switch to start the engine.
- NEVER jump start the engine. Sparks caused by jumping the battery to the starter terminals may cause a fire or explosion.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Place an approved container under the air bleed port when you prime the fuel system. Never use a shop rag to catch the fuel. Wipe up any spills immediately. ALWAYS close the air bleed port after you complete priming the system.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you open the air bleed port.
- If the unit has an electric fuel pump, turn the key switch to the ON position for 10 to 15 seconds, or until the fuel coming out of the air bleed port is free of bubbles, to allow the electric fuel pump to prime the system.
- If the unit has a mechanical fuel pump, operate the fuel priming pump several times until the fuel coming out of the air bleed port is free of bubbles.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- NEVER use diesel fuel as a cleaning agent.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- NEVER remove the fuel cap with engine running.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Only fill fuel tank with diesel fuel. Filling fuel tank with gasoline may result in a fire.
- NEVER refuel with engine running.
- Wipe up all spills immediately.
- Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) away when fueling / refueling.
- NEVER overfill the fuel tank.
- Fill fuel tank and store fuel in a well-ventilated area only.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Be sure to place the diesel fuel container on the ground when transferring diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity build-up which could cause sparks and ignite fuel vapors.
- NEVER place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shut down.
- Failure to comply will result in death or serious injury.

⚠ DANGER

CRUSH HAZARD!

- When you need to transport an engine for repair have a helper assist you attach it to a hoist and load it on a truck.
- NEVER stand under hoisted engine. If the hoist mechanism fails, the engine will fall on you, causing serious injury or death.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 2000 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 2000 hours of engine operation, whichever comes first.
- Failure to comply will result in death or serious injury.

⚠ DANGER

EXPLOSION HAZARD!

- NEVER check the remaining battery charge by shorting out the terminals. This will result in a spark and may cause an explosion or fire. Use a hydrometer to check the remaining battery charge.
- If the electrolyte is frozen, slowly warm the battery before you recharge it.
- Failure to comply will result in death or serious injury.

⚠ WARNING

SEVER HAZARD!

- Keep hands and other body parts away from moving / rotating parts such as the cooling fan, flywheel or PTO shaft.
- Wear tight fitting clothing and keep your hair short or tie it back while the engine is running.
- Remove all jewelry before you operate or service the machine.
- NEVER start the engine in gear. Sudden movement of the engine and / or machine could cause death or serious personal injury.
- NEVER operate the engine without the guards in place.
- Before you start the engine make sure that all bystanders are clear of the area.
- Keep children and pets away while the engine is operating.
- Check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.
- Failure to comply could result in death or serious injury.

⚠ WARNING

EXHAUST HAZARD!

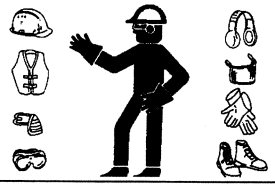
- NEVER operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.
- NEVER block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation. Accumulation of this gas within an enclosure could cause illness or even death.
- Make sure that all connections are tightened to specifications after repair is made to the exhaust system.
- Failure to comply could result in death or serious injury.

⚠ WARNING

ALCOHOL AND DRUG HAZARD!

- NEVER operate the engine while you are under the influence of alcohol or drugs.
- NEVER operate the engine when you are feeling ill.
- Failure to comply could result in death or serious injury.

⚠ WARNING



EXPOSURE HAZARD!

- Wear personal protective equipment such as gloves, work shoes, eye and hearing protection as required by the task at hand.
- NEVER wear jewelry, unbuttoned cuffs, ties or loose fitting clothing when you are working near moving / rotating parts such as the cooling fan, flywheel or PTO shaft.
- ALWAYS tie long hair back when you are working near moving / rotating parts such as a cooling fan, flywheel, or PTO shaft.
- NEVER operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear warning signals.
- Failure to comply could result in death or serious injury.

⚠ WARNING

BURN HAZARD!

- If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being scalded. Make sure you wear eye protection.
- Failure to comply could result in death or serious injury.

⚠ WARNING

BURN HAZARD!

- Batteries contain sulfuric acid. NEVER allow battery fluid to come in contact with clothing, skin or eyes. Severe burns could result. ALWAYS wear safety goggles and protective clothing when servicing the battery. If contact with the skin and / or eyes should occur, flush with a large amount of water and obtain prompt medical treatment.
- Failure to comply could result in death or serious injury.

⚠ WARNING

HIGH PRESSURE HAZARD!

- Avoid skin contact with high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray obtain prompt medical treatment.
- NEVER check for a fuel leak with your hands. ALWAYS use a piece of wood or cardboard. Have your authorized Yanmar industrial engine dealer or distributor repair the damage.
- Failure to comply could result in death or serious injury.

⚠ WARNING

SHOCK HAZARD!

- Turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the electrical system.
- Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors. ALWAYS keep the connectors and terminals clean.
- Failure to comply could result in death or serious injury.

⚠ WARNING

SEVER HAZARD!

- Stop the engine before you begin to service it.
- NEVER leave the key in the key switch when you are servicing the engine. Someone may accidentally start the engine and not realize you are servicing it. This could result in a serious injury.
- If you must service the engine while it is operating, remove all jewelry, tie back long hair, and keep your hands, other body parts and clothing away from moving / rotating parts.
- Failure to comply could result in death or serious injury.

⚠ WARNING

BURN HAZARD!

- Wait until the engine cools before you drain the engine coolant. Hot engine coolant may splash and burn you.
- Failure to comply could result in death or serious injury.

⚠ WARNING

SUDDEN MOVEMENT HAZARD!

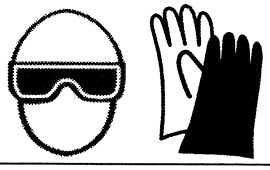
- Allow the engine to warm-up for at least 5 minutes to allow the engine idle speed to return to normal before engaging the transmission or any PTO attachments. Engaging the transmission or PTO at an elevated engine speed could result in an unexpected movement of the equipment.
- Failure to comply could result in death or serious injury.

⚠ WARNING

BURN HAZARD!

- Keep your hands, and other body parts, away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.
- Failure to comply could result in death or serious injury.

⚠ CAUTION



COOLANT HAZARD!

- Wear eye protection and rubber gloves when you handle Long Life or Extended Life Engine Coolant. If contact with the eyes or skin should occur, wash with clean water.
- Failure to comply may result in minor or moderate injury.

⚠ CAUTION

FLYING OBJECT HAZARD!

- ALWAYS wear eye protection when servicing engine and when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.
- Failure to comply may result in minor or moderate injury.

CAUTION

- Only use diesel fuels recommended by Yanmar for the best engine performance, to prevent engine damage and to comply with EPA / ARB warranty requirements.
- Only use clean diesel fuel.
- NEVER remove primary strainer from the filler port. If removed, dirt and debris could get into the fuel system causing it to clog.

CAUTION

NEVER attempt to adjust the low or high idle speed limit screw. This may impair the safety and performance of the machine and shorten its life.

CAUTION

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

CAUTION

NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

CAUTION

Make sure the engine is installed on a level surface. If a continuously running engine is installed at an angle greater than 30° (in any direction) or if an engine runs for short periods of time (less than 3 minutes) at an angle greater than 35° (in any direction) engine oil may enter the combustion chamber causing exessive engine speed and generate white smoke. This may cause serious engine damage.

CAUTION

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- Avoid operating in extremely dusty conditions.
- Avoid operating in the presence of chemical gases or fumes.
- Avoid operating in a corrosive atmosphere such as salt water spray.
- NEVER install the engine in a floodplain unless proper precautions are taken to avoid being subject to a flood.
- NEVER expose the engine to the rain.

CAUTION

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- NEVER run the engine if the ambient temperature is above +113°F (+45°C) or below +5°F (-15°C).
  - If the ambient temperature exceeds +113°F (+45°C) the engine may overheat and cause the engine oil to break down.
  - If the ambient temperature falls below +5°F (-15°C) rubber components such as gaskets and seals will harden causing premature engine wear and damage.
  - Contact your authorized Yanmar industrial engine dealer or distributor if the engine will be operated in either temperature extreme.
- Contact your authorized Yanmar industrial engine dealer or distributor if you need to operate the engine at high altitudes. At high altitudes the engine will lose power, run rough, and produce exhaust gases that exceed the design specifications.

CAUTION

The illustrations and descriptions of optional equipment in this manual, such as the operator's console, are for a typical engine installation. Refer to the documentation supplied by the optional equipment manufacturer for specific operation and maintenance instructions.

CAUTION

If any indicator illuminates during engine operation stop the engine immediately. Determine the cause and repair the problem before you continue to operate the engine.

CAUTION

- Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.
- Prevent dirt and debris from contaminating engine oil. Carefully clean the oil cap / dipstick and the surrounding area before you remove the cap.
- NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.
- NEVER overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.

CAUTION

- Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal build up of rust and scale and / or shorten engine life.
- Prevent dirt and debris from contaminating engine coolant. Carefully clean the radiator cap and the surrounding area before you remove the cap.
- NEVER mix different types of engine coolants. This may adversely affect the properties of the engine coolant.

CAUTION

- NEVER overfill the engine with engine oil.
- ALWAYS keep the oil level between upper and lower lines on the dipstick.

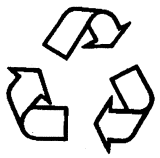
CAUTION

For maximum engine life, Yanmar recommends that when shutting the engine down, you allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.

CAUTION

NEVER use an engine starting aid such as ether. Engine damage will result.

CAUTION



Be responsible to the environment. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.

- Follow the guidelines of the EPA or other governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.

CAUTION

New Engine Break In:

- On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, coolant leaks, and for proper operation of the indicators and / or gauges.
- During the first hour of operation, vary the engine speed and load on the engine. Short periods of maximum engine speed and load are desirable. Avoid prolonged operation at minimum or maximum engine speeds and loads for the next 4 to 5 hours.
- During the break-in period, carefully observe the engine oil pressure and engine temperature.
- During the break-in period, check the engine oil and coolant levels frequently.

CAUTION

NEVER engage the starter motor while the engine is running. This may damage the starter motor pinion and / or ring gear.

CAUTION

- NEVER attempt to modify the engine's design or safety features such as defeating the engine speed limit control or the fuel injection quantity control.
- Failure to comply may impair the engine's safety and performance characteristics and shorten the engine's life. Any alterations to this engine may affect the warranty coverage of your engine. *See Yanmar Limited Warranty on page vii.*

CAUTION

Protect the air cleaner, turbocharger (if equipped) and electric components from damage when you use steam or use high-pressure water to clean the engine.

CAUTION

NEVER use high pressure water or compressed air at greater than 28 psi or a wire brush to clean the radiator fins. Radiator fins damage easily.

CAUTION

NEVER attempt to adjust the low or high idle speed limit screw. This may impair the safety and performance of the machine and shorten its life.

CAUTION

The tightening torque in the Standard Torque Chart *(page 70)* should be applied only to the bolts with a "7" head. (JIS strength classification: 7T)

- Apply 60% torque to bolts that are not listed.
- Apply 80% torque when tightened to aluminum alloy.

CAUTION

If any indicator fails to illuminate when the key switch is in the ON position, see your authorized Yanmar industrial engine dealer or distributor for service before operating the engine.

CAUTION

Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the engine's safety and performance characteristics, shorten the engine's life and may affect the warranty coverage on your engine. *See Yanmar Limited Warranty on page vii.*

Consult your authorized Yanmar industrial engine dealer or distributor for assistance when checking items marked with a ●.

CAUTION

If no water drips when the fuel filter / water separator drain cock is opened, loosen the air vent valve on the top of the fuel filter / water separator by using a screwdriver to turn it counterclockwise 2-3 turns.

This may occur if the fuel filter / water separator is positioned higher than the fuel level in the fuel tank. After draining the fuel filter / water separator, be sure to tighten the air vent screw.

CAUTION

- When the engine is operated in dusty conditions, clean the air cleaner element more frequently.
- NEVER operate the engine with the air cleaner or element removed. This may cause foreign material to enter the engine and damage it.

CAUTION

The maximum air intake restriction shall be 0.90 psi (6.23 kPa; 635 mm Aq) or less. Clean or replace the air cleaner element if the air intake restriction exceeds the above mentioned value.

CAUTION

Make it a habit to perform daily checks. *See Daily Checks on page 41.*

Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor machine performance and helps extend the life of the engine.

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PRODUCT OVERVIEW

YANMAR TNV ENGINE FEATURES AND APPLICATIONS

Yanmar's series of TNV engines are environmentally friendly and are designed to:

- Lower the amount of exhaust gas emissions.
- Reduce engine noise and vibration.
- Be easy to start thanks to the specially designed fuel injection pump and combustion system.
- Be economical to run because diesel fuel and engine oil consumption are reduced.
- Be easy to operate due to the minimum amount of required maintenance and its compact design.
- Be durable and reliable due in part to the newly designed fuel injection valve and fuel injection pump.

Yanmar TNV engines are designed to supply power to a wide variety of driven machines including:

- Construction
- Agriculture
- Power Generation

We are sure that you will agree these features provide excellent value in an industrial diesel engine.

These engines are designed to deliver power to driven machines by means of a "direct coupled drive" or "belt drive." In direct coupled drive engine applications, the engine's flywheel housing or end plate is coupled directly to the driven machine. In belt drive engine applications, a belt drive is used to power the driven machine. If you have applications that require a belt drive and / or front power take-off (PTO), please contact your authorized Yanmar industrial engine dealer or distributor.

The engine is designed for a wide range of applications. Options (such as fuel tank, control panel, indicators, gauges and alarms) are available to customize the application.

Since designing the application and installing the engine require special knowledge and skill, always consult your authorized Yanmar industrial engine dealer or distributor for these services. They will help you:

- Select optional equipment. Optional equipment should be selected to match the work conditions and environment.
- Maximize engine performance with a minimum amount of downtime and safety related incidents by carefully matching the characteristics of the engine with the driven machine.
- Plan for safe fuel piping, exhaust piping, electrical wiring, ventilation and accurate engine installation.
- Design your applications so they meet requirements of the local authorities.

COMPONENT IDENTIFICATION

Figure 1 shows where major engine components are located.

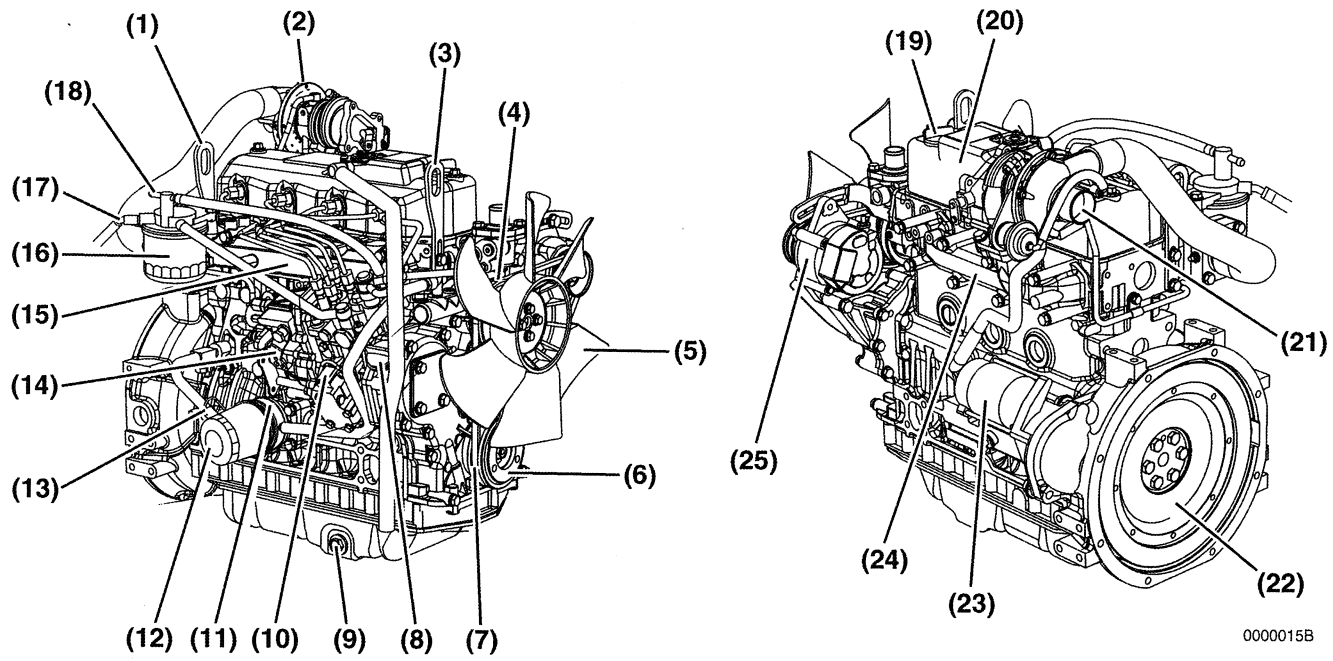


Figure 1

1. Lifting Eye (Flywheel End)
2. Turbocharger*
3. Lifting Eye (Engine Cooling Fan End)
4. Engine Coolant Pump
5. Engine Cooling Fan
6. Crankshaft V-Pulley
7. V-Belt
8. Side Filler Port (Engine Oil)
9. Drain Plug (Engine Oil)**
10. Fuel Injection Pump
11. Engine Oil Cooler
12. Engine Oil Filter
13. Dipstick (Engine Oil)
14. Governor Lever
15. Intake Manifold
16. Fuel Filter
17. Fuel Inlet
18. Fuel Return To Fuel Tank
19. Top Filler Port (Engine Oil)
20. Rocker Arm Cover
21. Air Intake Port (From Air Cleaner)
22. Flywheel
23. Starter Motor
24. Exhaust Manifold
25. Alternator

*Only applies to 3TNV84T, 4TNV84T, 4TNV98T, 4TNV106T
** Engine oil drain plug location may vary based on oil pan options.

LOCATION OF LABELS

Figure 2 shows the location of regulatory and safety labels on Yanmar TNV series engines.

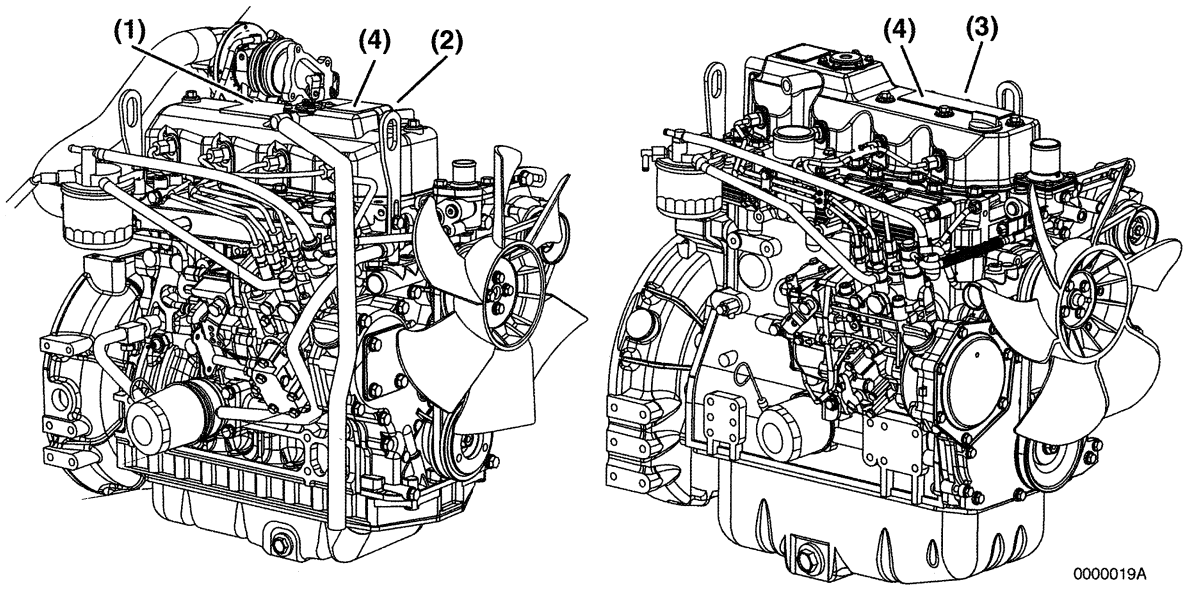


Figure 2

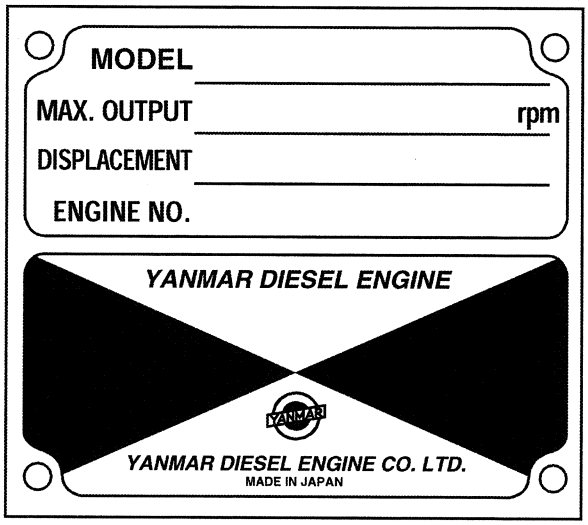
The typical location of the emission control information label is shown for 4TNV84, 4TNV84T and 4TNV88 engines **(Figure 2, (1))**.

The typical location of the emission control information label is affixed to the exhaust side of the rocker arm cover for 3TNV82A, 3TNV84, 3TNV84T and 3TNV88 engines **(Figure 2, (2))**.

The typical location of the emission control information label is affixed to the exhaust side of the rocker arm cover for 4TNV94L, 4TNV98, 4TNV98T, 4TNV106 and 4TNV106T engines **(Figure 2, (3))**.

Typical location of the engine nameplate is shown for various Yanmar TNV engines **(Figure 2, (4))**.

Engine Nameplate (Typical)



EPA / ARB EMISSION CONTROL REGULATIONS - USA ONLY

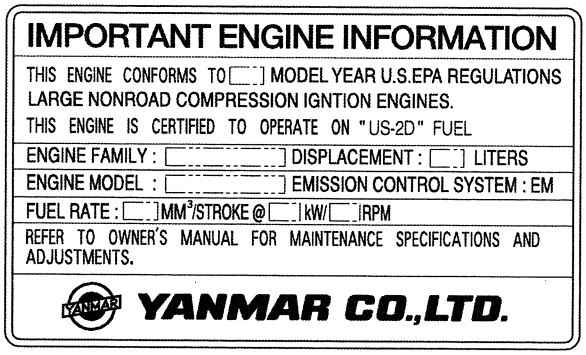
Yanmar TNV engines meet Environmental Protection Agency (EPA) (U. S. Federal) emission control standards as well as the California Air Resources Board (ARB, California) regulations. Only engines that conform to ARB regulations can be sold in the State of California.

Refer to the specific EPA / ARB installation *(page 70)* and maintenance *(page 71)* in the *Periodic Maintenance* section of this manual. Also refer to the *Yanmar Co., Ltd. Limited Emission Control on page x.*

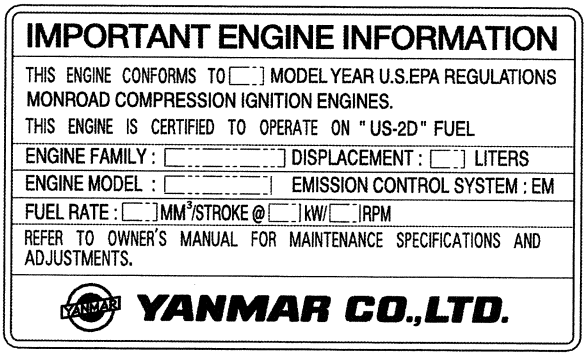
EMISSION CONTROL LABELS

Since emission control regulations are being issued on a global basis, it is necessary to identify which regulations a particular engine complies with. We have listed several different types of labels you might find on your engine.

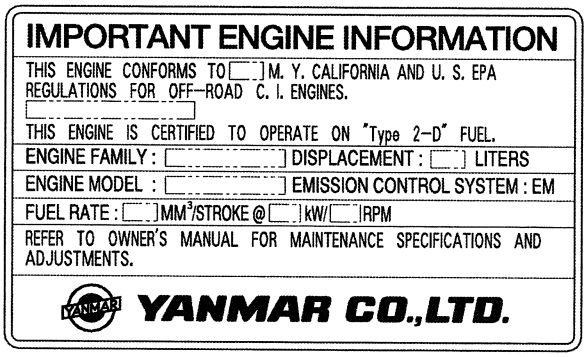
EPA / ARB Labels



(EPA) Greater Than or Equal To 50 HP SAE (37kW)



(EPA) Less Than 50 HP SAE (37kW)

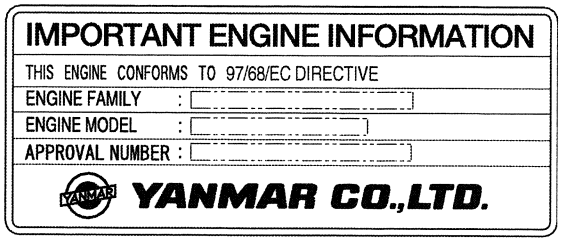


(EPA & ARB)

THE 97/68/EC DIRECTIVE CERTIFIED ENGINES

The engines described in this manual have been certified by the 97/68/EC Directive.

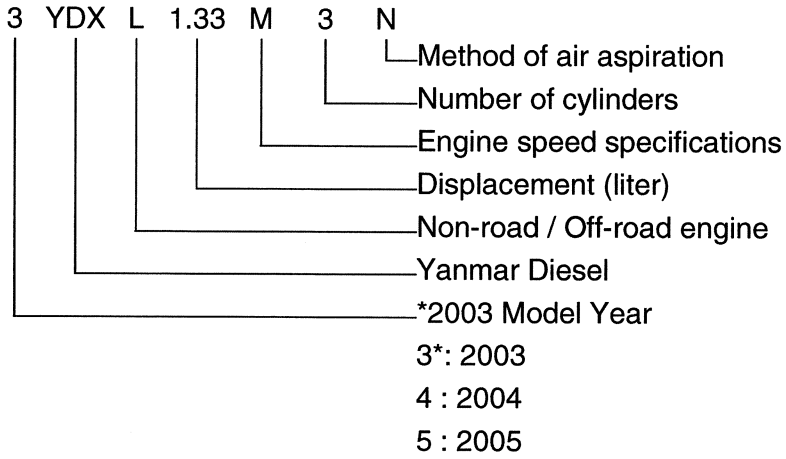
To identify the engines that meet this certification, the 97/68/EC emission control label is affixed on the engines.



(97/68/EC)

ENGINE FAMILY

The EPA / ARB labels and the 97/68/EC label all have an *Engine Family* field. The following is an explanation of the *Engine Family* designation:



FUNCTION OF MAJOR ENGINE COMPONENTS

Components	Functions
Air Cleaner	The air cleaner prevents airborne contaminants from entering the engine. Since the air cleaner is application specific, it must be carefully selected by an application engineer. It is not part of the basic engine package as shipped from the Yanmar factory. Periodic replacement of the air cleaner filter element is necessary. See the *Periodic Maintenance Schedule on page 71* for the replacement frequency.
Alternator	The alternator is driven by a V-belt which is powered by the crankshaft V-pulley. The alternator supplies electricity to the engine systems and charges the battery while the engine is running.
Dipstick (Engine Oil)	The engine oil dipstick is used to determine the amount of engine oil in the crankcase.
Electric Fuel Pump	The electric fuel pump makes sure there is a constant supply of diesel fuel to the fuel injection pump. The electric fuel pump is electro-magnetic and runs on 12 VDC. It must be installed on every application. This is standard equipment with every engine.
Engine Oil Filter	The engine oil filter removes contaminants and sediments from the engine oil. Periodic replacement of the engine oil filter is necessary. See the *Periodic Maintenance Schedule on page 71* for the replacement frequency.
Engine Oil Cooler	The engine oil cooler helps to keep the engine oil cool. Engine coolant from the cooling system is circulated through an adapter at the base of the engine oil filter assembly and then returned to the cylinder block.
Fuel Filter	The fuel filter removes contaminants and sediments from the diesel fuel. Periodic replacement of the fuel filter is necessary. See the *Periodic Maintenance Schedule on page 71* for the replacement frequency. ***Please note that the word "diesel" is implied throughout this manual when the word "fuel" is used.***
Fuel Filter / Water Separator	The fuel filter / water separator removes contaminants, sediments and water from diesel fuel going to the fuel filter. This is a required component of the fuel system. This is standard equipment with every engine. The separator is installed between the fuel tank and the electric fuel pump. Periodically drain the water from the fuel filter / water separator using the drain cock at the bottom of the separator.

Components	Functions
Fuel Tank	The fuel tank is a reservoir that holds diesel fuel. When fuel leaves the fuel tank it goes to the fuel filter / water separator. Next, fuel is pumped to the fuel filter by the electric fuel pump. Next the fuel goes to the fuel injection pump. Since fuel is used to keep the fuel injection pump cool and lubricated, more fuel than necessary enters the injection pump. When the injection pump pressure reaches a preset value, a relief valve allows excess fuel to be returned back to the fuel tank. The fuel tank is a required engine component.
Side and Top Filler Port (Engine Oil)	You can fill the crankcase with engine oil from ***either the side or top filler port*** depending upon which one is most convenient.
Starter Motor	The starter motor is powered by the battery. When you turn the key switch in the operator's console to the START position, the starter motor engages with the ring gear installed on the flywheel and starts the flywheel in motion.
Turbocharger (Only applies to 3TNV84T, 4TNV84T, 4TNV98T, 4TNV106T)	The turbocharger pressurizes the air coming into the engine. It is driven by a turbine that is energized by exhaust gases.

FUNCTION OF COOLING SYSTEM COMPONENTS

Components	Functions
Cooling System	The TNV engine is liquid-cooled by means of a cooling system. The cooling system consists of a radiator, radiator cap, engine cooling fan, engine coolant pump, thermostat, and reserve tank. ***Note that all cooling system components are required for proper engine operation. Since some of the components are application specific, they must be carefully selected by an application engineer. The application specific items are not part of the basic engine package as shipped from the Yanmar factory.***
• Engine Cooling Fan	The engine cooling fan is driven by a V-belt which is powered by the crankshaft V-pulley. The purpose of the engine cooling fan is to circulate air through the radiator.
• Engine Coolant Pump	The engine coolant pump circulates the engine coolant through the cylinder block and cylinder head and returns the engine coolant to the radiator.
• Radiator	The radiator acts as a heat exchanger. As the engine coolant circulates through the cylinder block it absorbs heat. The heat in the engine coolant is dissipated in the radiator. As the engine cooling fan circulates air through the radiator, the heat is transferred to the air.
• Radiator Cap	The radiator cap controls the cooling system pressure. The cooling system is pressurized to raise the boiling point of the engine coolant. As the engine coolant temperature rises, the system pressure and the coolant volume increases. When the pressure reaches a preset value, the release valve in the radiator cap opens and the excess engine coolant flows into the reserve tank. As the engine coolant temperature is reduced, the system pressure and volume is reduced and the vacuum valve in the radiator cap opens allowing engine coolant to flow from the reserve tank back into the radiator.
• Reserve Tank	The reserve tank contains the overflow of engine coolant from the radiator. If you need to add engine coolant to the system, add it to the reserve tank, not the radiator.
• Thermostat	A thermostat is placed in the cooling system to prevent engine coolant from circulating into the radiator until the engine coolant temperature reaches a preset temperature. When the engine is cold, no engine coolant flows through the radiator. Once the engine reaches its operating temperature the thermostat opens. By letting the engine warm up as quickly as possible, the thermostat reduces engine wear, deposits and emissions.

GAUGES AND INDICATORS

The operator's console provides you with the means to start and stop the unit and a series of gauges and indicators that inform you about the current status of the engine. This is a required engine component. Since the operator's console is application specific, it must be carefully selected by an application engineer. It is not part of the basic engine package as shipped from the Yanmar factory.

CAUTION

The illustrations and descriptions of optional equipment in this manual, such as the operator's console, are for a typical engine installation. Refer to the documentation supplied by the optional equipment manufacturer for specific operation and maintenance instructions.

Gauges

The following gauges are located on a typical operator's console. Some operator's consoles may not have the gauges described here or may have different gauges.

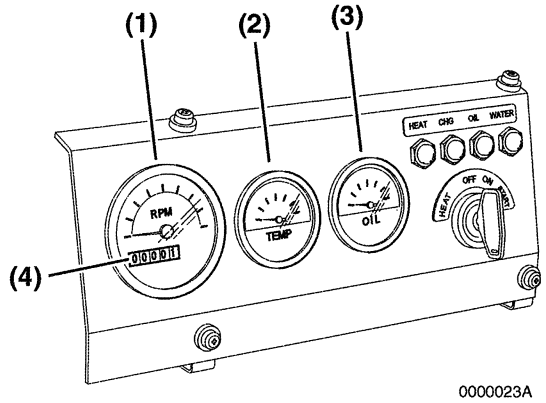


Figure 3

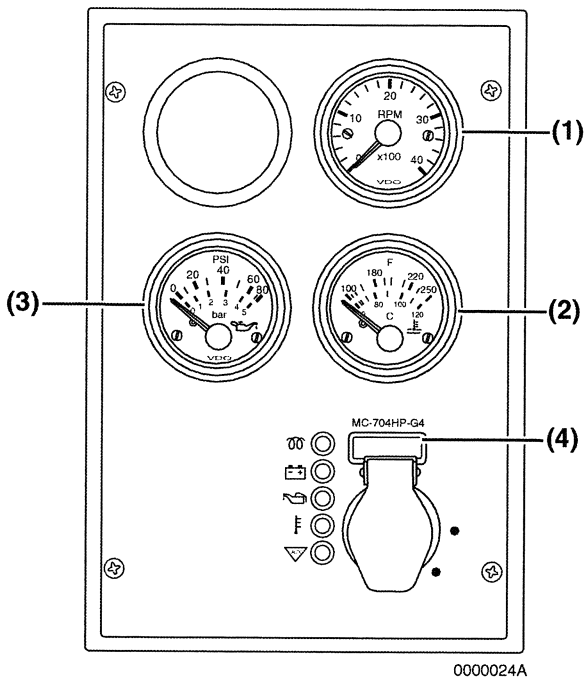


Figure 4

Tachometer - The tachometer display **(Figure 3, (1))** or **(Figure 4, (1))** shows the engine speed in Revolutions Per Minute (rpm).

Engine Coolant Temperature - The engine coolant temperature display **(Figure 3, (2))** or **(Figure 4, (2))** shows the temperature of the engine coolant.

Engine Oil Pressure - The engine oil pressure display **(Figure 3, (3))** or **(Figure 4, (3))** shows the pressure of the engine oil.

Hour Meter - The hour meter display **(Figure 3, (4))** or **(Figure 4, (4))** shows the total number of hours the engine has run. This is useful for planning the *Periodic Maintenance* operations *on page 71.*

Indicators

The following indicators are located on a typical operator's console.

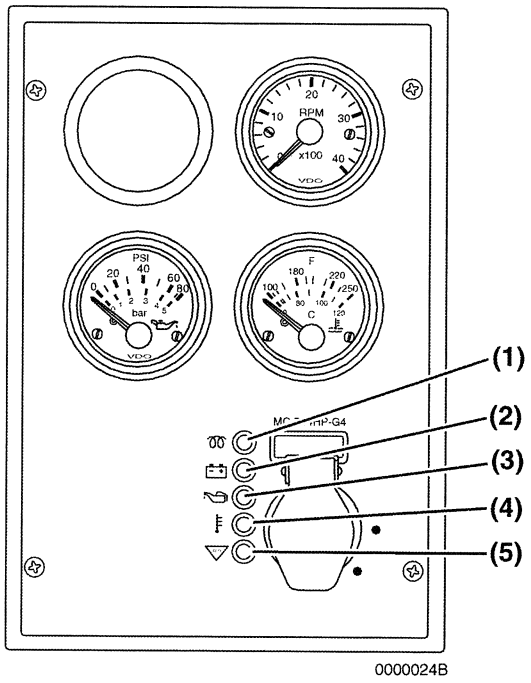


Figure 5

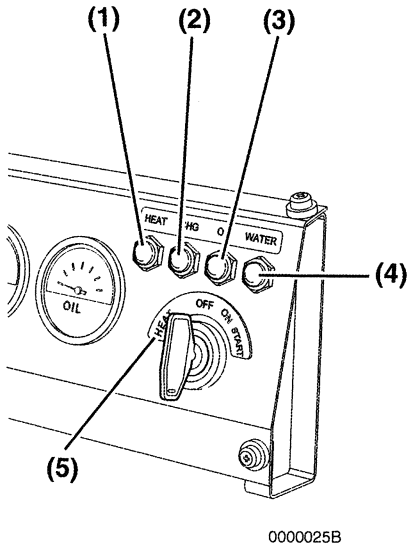


Figure 6

Pre-Heat - (Figure 5, (1)) - The pre-heat function is automatically activated when the key switch is turned to the ON position. The indicator flashes for several seconds and when it goes out you can turn the key switch to START.

Heat - (Figure 6, (1)) - Note that you must turn the key to the HEAT position **(Figure 6, (5))** to activate the inlet air heater. The indicator will flash for several seconds when you turn the key to HEAT and when it goes out, you can turn the key switch to START.

Battery - (Figure 5, (2)) or **(Figure 6, (2))** - This indicator will come on if there is a problem in the charging system. This indicator does not indicate whether the battery is discharged. *See Troubleshooting Chart on page 93.*

Engine Oil Pressure - (Figure 5, (3)) or **(Figure 6, (3))** - This indicator will come on if the engine oil pressure is below or exceeds normal limits. *See Troubleshooting Chart on page 93.*

Engine Coolant Temperature - (Figure 5, (4)) or **(Figure 6, (4))** - This indicator will come on if the engine coolant temperature exceeds normal limits. *See Troubleshooting Chart on page 93.*

Auxiliary - (Figure 5, (5)) - Used for special applications.

CONTROLS

Key Switch

The key switch for the operator's console illustrated in **Figure 7** has three positions - OFF, ON, and START.

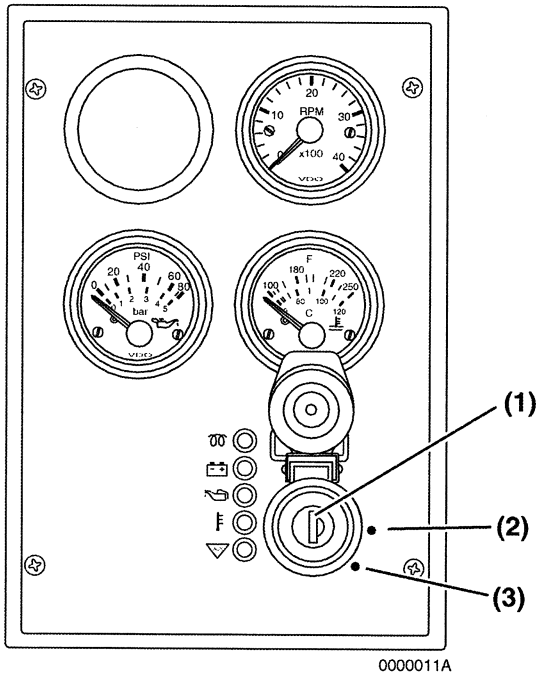


Figure 7

CAUTION

For maximum engine life, Yanmar recommends that when shutting the engine down, you allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.

OFF (key straight up and down) **(Figure 7, (1))** - When you turn the key to this position the engine shuts down. Electric current to the gauges and indicators is shut off. You can insert and remove the key in this position.

ON **(Figure 7, (2))** - This is the position the key will be in when the engine is running. When the engine is not running, use this position to energize the gauges, indicators, electric fuel pump and auxiliary devices.

CAUTION

NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

START **(Figure 7, (3))** - Turn the key to this position to start the engine. As soon as the engine starts, release the key and it will automatically return to the ON position. Some key switches may be equipped with a feature that prevents you from turning the key to the START position while the engine is running. In these configurations, you cannot turn the key to the START position without first returning the key to the OFF position.

The key switch for the operator's console illustrated in **Figure 8** has four positions - OFF, ON, START, and HEAT.

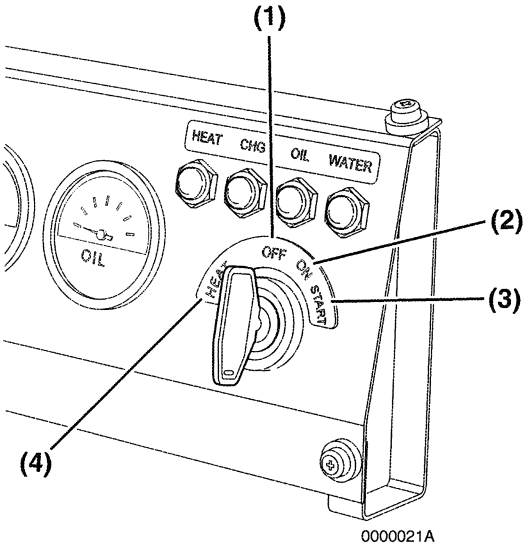


Figure 8

CAUTION

For maximum engine life, Yanmar recommends that when shutting the engine down, you allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.

OFF **(Figure 8, (1))** - When you turn the key to this position the engine shuts down. Electric current to the gauges and indicators is shut off. You can insert and remove the key in this position.

ON **(Figure 8, (2))** - This is the position the key will be in when the engine is running. When the engine is not running, use this position to energize the gauges, indicators, electric fuel pump and auxiliary devices.

CAUTION

NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

START **(Figure 8, (3))** - Turn the key to this position to start the engine. As soon as the engine starts, release the key and it will automatically return to the ON position. Some key switches may be equipped with a feature that prevents you from turning the key to the START position while the engine is running. You cannot turn the key to the START position without first returning the key to the OFF position.

HEAT **(Figure 8, (4))** - You must turn the key to the HEAT position to activate the inlet air heater. The indicator will flash for several seconds when you turn the key to HEAT. You can turn the key to START when the indicator goes out.

Inlet Air Heater

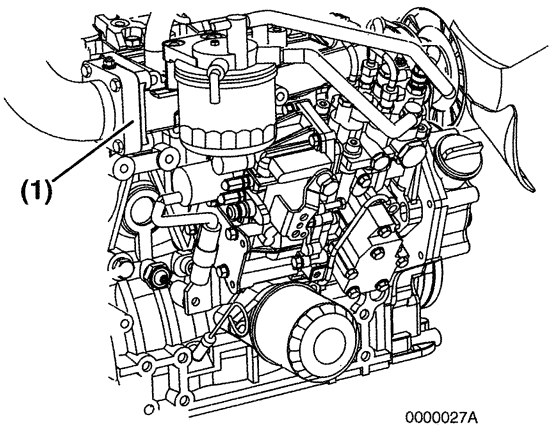


Figure 9

The inlet air heater **(Figure 9, (1))** is located on the intake manifold. Heated inlet air helps the engine to start easier in cold weather. During the engine starting sequence the inlet air heater is activated for several seconds. After the pre-heat / heat indicator goes out, the engine can be started. The inlet air heater is standard equipment with every engine.

Governor Lever

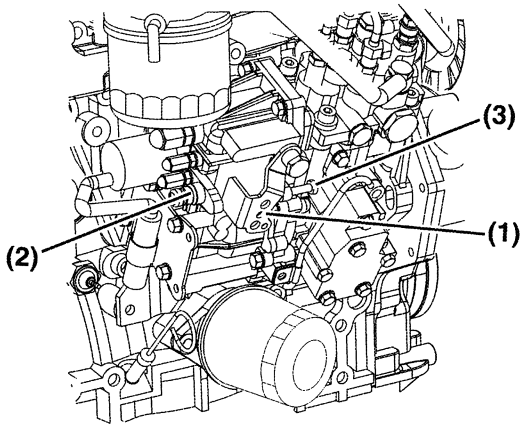


Figure 10

CAUTION
NEVER attempt to adjust the low or high idle speed limit screw. This may impair the safety and performance of the machine and shorten its life.

The governor lever **(Figure 10, (1))** controls the engine speed. The lever is linked to the engine speed control device in the driven machine.

The high idle speed limit screw **(Figure 10, (2))** restricts the maximum engine speed when the engine is operated without a load.

The low idle speed limit screw **(Figure 10, (3))** sets engine speed while it is idling.

Engine Stop Solenoid

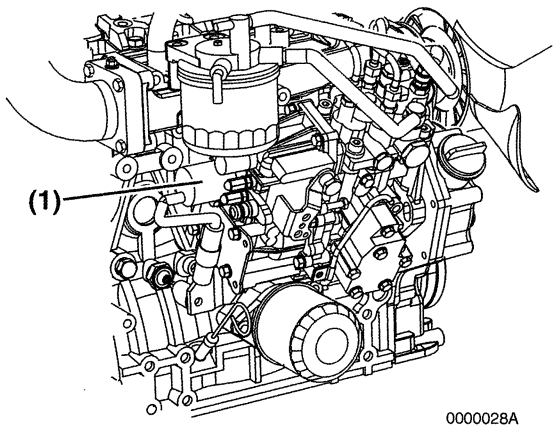


Figure 11

When the key is turned to the ON position, the engine stop solenoid **(Figure 11, (1))** is energized and allows the fuel injection pump to deliver fuel to the engine, allowing the engine to be started. When the key is turned to the OFF position, the engine stop solenoid is de-energized and shuts off the fuel supply from the fuel injection pump to the engine, causing the engine to stop.

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BEFORE YOU OPERATE

This section of the *Operation Manual* describes the diesel fuel, engine oil, and engine coolant specifications and how to replenish them. It also describes the daily engine checkout.

⚠ DANGER

SCALD HAZARD!

- **NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.**
- **Securely tighten the radiator cap after you check the radiator. Steam can spurt out during engine operation if the cap is loose.**
- **ALWAYS check the level of engine coolant by observing the reserve tank.**
- **Failure to comply will result in death or serious injury.**

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is extremely flammable and explosive under certain conditions.**
- **When you prime the fuel system, operate the fuel priming lever of the mechanical fuel pump several times until the fuel filter cup is filled with fuel.**
- **NEVER open the air vent valve while the fuel system is being primed. The fuel filter has an internal air bleed port.**
- **Failure to comply will result in death or serious injury.**

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Only fill fuel tank with diesel fuel. Filling fuel tank with gasoline may result in a fire.
- NEVER refuel with engine running.
- Wipe up all spills immediately.
- Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) away when fueling / refueling.
- NEVER overfill the fuel tank.
- Fill fuel tank and store fuel in a well-ventilated area only.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Be sure to place the diesel fuel container on the ground when transferring diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity build-up which could cause sparks and ignite fuel vapors.
- NEVER place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shut down.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 2000 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 2000 hours of engine operation, whichever comes first.
- Failure to comply will result in death or serious injury.

⚠ WARNING

HIGH PRESSURE HAZARD!

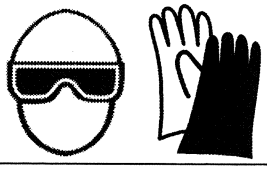
- Avoid skin contact with high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray obtain prompt medical treatment.
- NEVER check for a fuel leak with your hands. ALWAYS use a piece of wood or cardboard. Have your authorized Yanmar industrial engine dealer or distributor repair the damage.
- Failure to comply could result in death or serious injury.

⚠ WARNING

BURN HAZARD!

- Wait until the engine cools before you drain the engine coolant. Hot engine coolant may splash and burn you.
- Failure to comply could result in death or serious injury.

⚠ CAUTION



COOLANT HAZARD!

- Wear eye protection and rubber gloves when you handle Long Life or Extended Life Engine Coolant. If contact with the eyes or skin should occur, wash with clean water.
- Failure to comply may result in minor or moderate injury.

CAUTION

- Only use diesel fuels recommended by Yanmar for the best engine performance, to prevent engine damage and to comply with EPA / ARB warranty requirements.
- Only use clean diesel fuel.
- NEVER remove primary strainer from the filler port. If removed, dirt and debris could get into the fuel system causing it to clog.

CAUTION

- Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.
- Prevent dirt and debris from contaminating engine oil. Carefully clean the oil cap / dipstick and the surrounding area before you remove the cap.
- NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.
- NEVER overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.

CAUTION

- Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal build up of rust and scale and / or shorten engine life.
- Prevent dirt and debris from contaminating engine coolant. Carefully clean the radiator cap and the surrounding area before you remove the cap.
- NEVER mix different types of engine coolants. This may adversely affect the properties of the engine coolant.

CAUTION

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

DIESEL FUEL

Diesel Fuel Specifications

Diesel fuel should comply with the following specifications. The table lists several worldwide specifications for diesel fuels.

Diesel Fuel Specification	Location
No. 2-D, No. 1-D, ASTM D975-94	USA
EN590:96	European Union
ISO 8217 DMX	International
BS 2869-A1 or A2	United Kingdom
JIS K2204 Grade No.2	Japan
KSM-2610	Korea
GB252	China

Additional Technical Fuel Requirements

- The fuel cetane number should be equal to 45 or higher.
- The sulfur content must not exceed 0.5% by volume. Less than 0.05% is preferred.
- Bio-Diesel fuels. *See Bio-Diesel Fuels on page 33.*
- NEVER mix kerosene, used engine oil, or residual fuels with the diesel fuel.
- Water and sediment in the fuel should not exceed 0.05% by volume.
- Keep the fuel tank and fuel-handling equipment clean at all times.
- Poor quality fuel can reduce engine performance and / or cause engine damage.
- Fuel additives are not recommended. Some fuel additives may cause poor engine performance. Consult your Yanmar representative for more information.
- Ash content not to exceed 0.01% by volume.
- Carbon residue content not to exceed 0.35% by volume. Less than 0.1% is preferred.
- Total aromatics content should not exceed 35% by volume. Less than 30% is preferred.
- PAH (polycyclic aromatic hydrocarbons) content should be below 10% by volume.
- Metal content of Na, Mg, Si, and Al should be equal to or lower than 1 mass ppm. (Test analysis method JPI-5S-44-95)
- Lubricity: Wear mark of WS1.4 should be Max. 0.018 in (460 µm) at HFRR test.

Bio-Diesel Fuels

In Europe and in the United States, as well as some other countries, non-mineral oil based fuel resources such as RME (Rapeseed Methyl Ester) and SOME (Soybean Methyl Ester), collectively known as FAME (Fatty Acid Methyl Esters), are being used as extenders for mineral oil derived diesel fuels.

Yanmar approves the use of bio-diesel fuels that do not exceed a blend of 5% (by volume) of FAME with 95% (by volume) of approved mineral oil derived diesel fuel. Such bio-diesel fuels are known in the marketplace as B5 diesel fuels.

These B5 diesel fuels must meet certain requirements.

1. The bio-fuels must meet the minimum specifications for the country in which they are used.
   - In Europe, bio-diesel fuels must comply with the European Standard EN14214.
   - In the United States, bio-diesel fuels must comply with the American Standard ASTM D-6751.
2. Bio-fuels should be purchased only from recognized and authorized diesel fuel suppliers.

Precautions and concerns regarding the use of bio-fuels:

1. Free methanol in FAME may result in corrosion of aluminum and zinc FIE components.
2. Free water in FAME may result in plugging of fuel filters and increased bacterial growth.

3. High viscosity at low temperatures may result in fuel delivery problems, injection pump seizures, and poor injection nozzle spray atomization.
4. FAME may have adverse effects on some elastomers (seal materials) and may result in fuel leakage and dilution of the engine lubricating oil.
5. Even bio-diesel fuels that comply with a suitable standard as delivered, will require additional care and attention to maintain the quality of the fuel in the equipment or other fuel tanks. It is important to maintain a supply of clean, fresh fuel. Regular flushing of the fuel system, and / or fuel storage containers, may be necessary.
6. The use of bio-diesel fuels that do not comply with the standards as agreed to by the diesel engine manufacturers and the diesel fuel injection equipment manufacturers, or bio-diesel fuels that have degraded as per the precautions and concerns above, may affect the warranty coverage of your engine. *See Yanmar Limited Warranty on page vii.*

FILLING THE FUEL TANK

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is extremely flammable and explosive under certain conditions.**
- **Only fill fuel tank with diesel fuel. Filling fuel tank with gasoline may result in a fire.**
- **NEVER refuel with engine running.**
- **Wipe up all spills immediately.**
- **Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) away when fueling / refueling.**
- **NEVER overfill the fuel tank.**
- **Fill fuel tank and store fuel in a well-ventilated area only.**
- **Failure to comply will result in death or serious injury.**

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is extremely flammable and explosive under certain conditions.**
- **Be sure to place the diesel fuel container on the ground when transferring diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity build-up which could cause sparks and ignite fuel vapors.**
- **NEVER place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shut down.**
- **Failure to comply will result in death or serious injury.**

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is extremely flammable and explosive under certain conditions.**
- **Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 2000 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 2000 hours of engine operation, whichever comes first.**
- **Failure to comply will result in death or serious injury.**

CAUTION

- **Only use diesel fuels recommended by Yanmar for the best engine performance, to prevent engine damage and to comply with EPA / ARB warranty requirements.**
- **Only use clean diesel fuel.**
- **NEVER remove primary strainer from the filler port. If removed, dirt and debris could get into the fuel system causing it to clog.**

Note that a typical fuel tank is shown. The fuel tank on your equipment may be different.

1. Clean the area around the fuel cap **(Figure 1, (1))**.
2. Remove the fuel cap **(Figure 1, (1))** from the fuel tank **(Figure 1, (2))**.

3. Observe the fuel level sight gauge **(Figure 1, (3))** and stop fueling when gauge shows fuel tank is full. NEVER overfill the fuel tank.
4. Replace the fuel cap **(Figure 1, (1))** and hand tighten. Over-tightening the fuel cap will damage it.

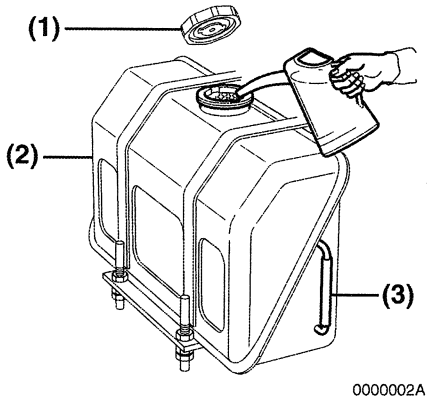


Figure 1

Priming The Fuel System

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is extremely flammable and explosive under certain conditions.**
- **When you prime the fuel system, operate the fuel priming lever of the mechanical fuel pump several times until the fuel filter cup is filled with fuel.**
- **NEVER open the air vent valve while the fuel system is being primed. The fuel filter has an internal air bleed port.**
- **Failure to comply will result in death or serious injury.**

The fuel system needs to be primed under certain conditions.

- Before starting the engine for the first time
- After running out of fuel and fuel has been added to the fuel tank
- After fuel system maintenance such as changing the fuel filter and draining the fuel filter / water separator, or replacing a fuel system component

To prime the fuel system:

1. Turn the key to the ON position for 10 to 15 seconds. This will allow the electric fuel pump to prime the fuel system.
2. NEVER use the starter motor to prime the fuel system. This may cause the starter motor to overheat and damage the coils, pinion and / or ring gear.

ENGINE OIL

CAUTION

- **Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.**
- **Prevent dirt and debris from contaminating engine oil. Carefully clean the oil cap / dipstick and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.**
- **NEVER overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.**

Engine Oil Specifications

Use an engine oil that meets or exceeds the following guidelines and classifications:

Service Categories

- API Service Categories CD or higher
- ACEA Service Categories E-3, E-4, and E-5
- JASO Service Category DH-1

Definitions

- API Classification (American Petroleum Institute)
- ACEA Classification (Association des Constructeurs Européens d'Automobilies)
- JASO (Japanese Automobile Standards Organization)

Notes:

1. Be sure the engine oil, engine oil storage containers, and engine oil filling equipment are free of sediments and water.
2. Change the engine oil after the first 50 hours of operation and then at every 250 hours thereafter.
3. Select the oil viscosity based on the ambient temperature where the engine is being operated. See the SAE Service Grade Viscosity Chart **(Figure 2)**.
4. Yanmar does not recommend the use of engine oil "additives."

Additional Technical Engine oil Requirements:

The engine oil must be changed when the Total Base Number (TBN) has been reduced to 2.0. TBN (mgKOH/g) test method; JIS K-201-5.2-2 (HCl), ASTM D4739 (HCl).

Engine Oil Viscosity

Select the appropriate engine oil viscosity based on the ambient temperature and use the SAE Service Grade Viscosity Chart in **Figure 2**.

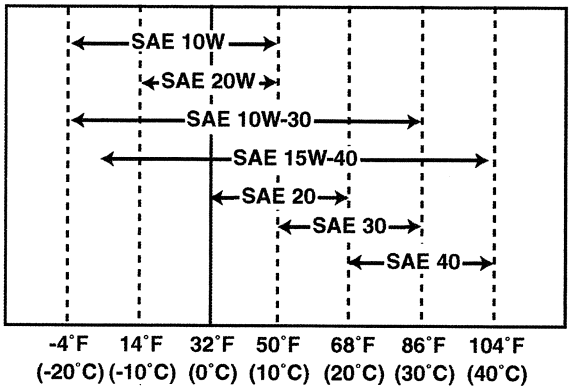


Figure 2

Checking Engine Oil

1. Make sure engine is level.
2. Remove dipstick **(Figure 3, (1))** and wipe with clean cloth.
3. Fully reinsert dipstick.
4. Remove dipstick. The oil level should be between upper **(Figure 3, (2))** and lower **(Figure 3, (3))** lines on the dipstick.
5. Fully reinsert dipstick.

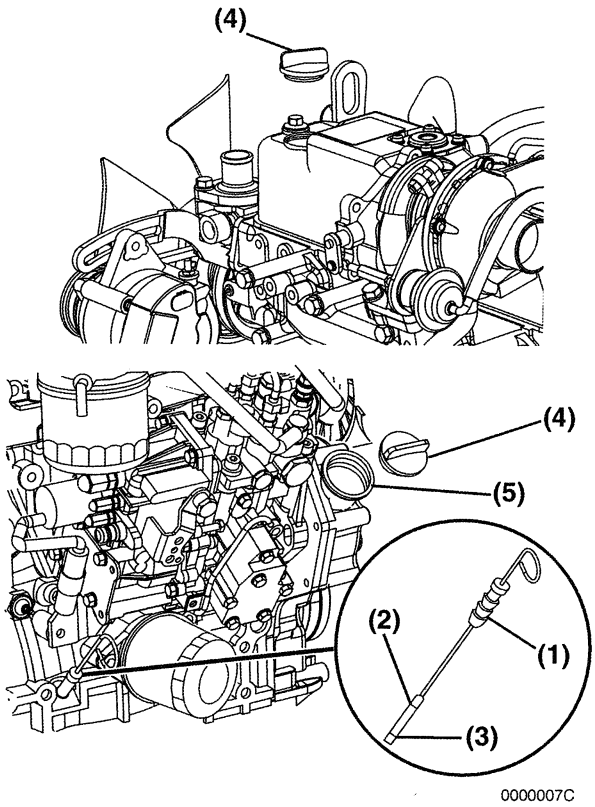


Figure 3

Adding Engine Oil

1. Make sure engine is level.
2. Remove oil cap **(Figure 3, (4))**.
3. Add indicated amount of engine oil at the top or side engine oil filler port **(Figure 3, (5))**.
4. Wait three minutes and check oil level.
5. Add more oil if necessary.
6. Replace oil cap **(Figure 3, (4))** and hand tighten. Over-tightening may damage the cap.

Engine Oil Capacity (Typical)

The following are the engine oil capacities for various Yanmar TNV engines.

Engine Model	Dipstick Upper Limit/ Lower Limit
3TNV82A	5.8 / 3.8 qt (5.5 / 3.6 L)
3TNV84, 3TNV84T	7.1 / 4.1 qt (6.7 / 3.9 L)
3TNV88	7.1 / 4.1 qt (6.7 / 3.9 L)
4TNV84, 4TNV84T	7.8 / 4.2 qt (7.4 / 4.0 L)
4TNV88	7.8 / 4.2 qt (7.4 / 4.0 L)
4TNV94L	11.1 / 6.3 qt (10.5 / 6.0 L)
4TNV98, 4TNV98T	11.1 / 6.3 qt (10.5 / 6.0 L)
4TNV106(CL), 4TNV106T(CL)	14.8 / 5.3 qt (14.0 / 5.0 L)
4TNV106(VM), 4TNV106T(VM)	14.8 / 6.9 qt (14.0 / 6.5 L)

Note: These are the engine oil capacities associated with a "Deep Standard" oil pan. Oil capacity will vary dependant upon which optional oil pan is used. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

ENGINE COOLANT

⚠ DANGER

SCALD HAZARD!

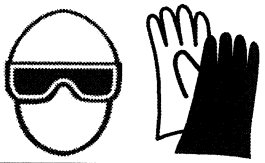
- **NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.**
- **Securely tighten the radiator cap after you check the radiator. Steam can spurt out during engine operation if the cap is loose.**
- **ALWAYS check the level of engine coolant by observing the reserve tank.**
- **Failure to comply will result in death or serious injury.**

⚠ WARNING

BURN HAZARD!

- **If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being scalded. Make sure you wear eye protection.**
- **Failure to comply could result in death or serious injury.**

⚠ CAUTION



COOLANT HAZARD!

- **Wear eye protection and rubber gloves when you handle Long Life or Extended Life Engine Coolant. If contact with the eyes or skin should occur, wash with clean water.**
- **Failure to comply may result in minor or moderate injury.**

CAUTION

- **Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal build up of rust and scale and / or shorten engine life.**
- **Prevent dirt and debris from contaminating engine coolant. Carefully clean the radiator cap and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine coolants. This may adversely affect the properties of the engine coolant.**

Engine Coolant Specifications

Use a Long Life Coolant (LLC) or an Extended Life Coolant (ELC) that meets or exceeds the following guidelines and specifications.

Alternative Engine Coolant

If an Extended or Long Life Coolant is not available, alternatively, you may use an ethylene glycol or propylene glycol based conventional coolant (green).

Notes:

1. ALWAYS use a mix of coolant and water. NEVER use water only.
2. Mix coolant and water per the mixing instructions on the coolant container.
3. Water quality is important to coolant performance. Yanmar recommends that soft, distilled, or demineralized water be used to mix with coolants.
4. NEVER mix extended or long life coolants and conventional (green) coolants.
5. NEVER mix different types and / or colors of extended life coolants.
6. Replace the coolant every 1000 engine hours or once a year.

Additional Technical Coolant Specifications:

- ASTM D6210, D4985 (US)
- JIS K-2234 (Japan)
- SAE J814C, J1941, J1034 or J2036 (International)

Filling Radiator With Engine Coolant

Fill the radiator and reserve tank as follows. This procedure is for filling the radiator for the first time or refilling it after it is flushed. Note that a typical radiator is illustrated.

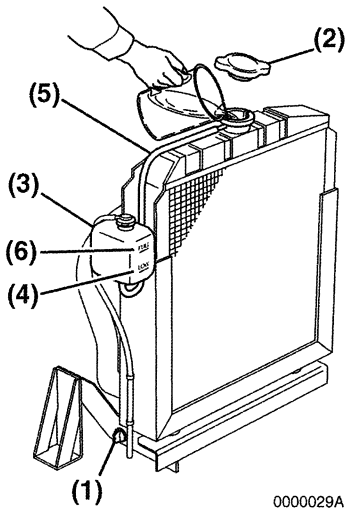


Figure 4

1. Check to be sure the drain plug **(Figure 4, (1))** is closed. Also make sure the coolant drain plug in the cylinder block is closed.
2. Remove the radiator cap **(Figure 4, (2))** by turning it counter-clockwise about 1/3 of a turn.
3. Pour the engine coolant *slowly* into the radiator until it is even with the lip of the engine coolant filler port. Make sure that air bubbles do not develop as you fill the radiator.
4. Fasten the radiator cap **(Figure 4, (2))**. Align the tabs on the back side of the radiator cap with the notches on the engine coolant filler port. Press down and turn the cap clockwise about 1/3 of a turn.
5. Remove the cap of the reserve tank **(Figure 4, (3))**, and fill it to the LOW (COLD) mark **(Figure 4, (4))** with engine coolant. Reinstall the cap.
6. Check the hose **(Figure 4, (5))** that connects the reserve tank **(Figure 4, (3))** to the radiator. Be sure it is securely connected and there are no cracks or damage. If the hose is damaged, engine coolant will leak out instead of going into the reserve tank.

7. Run the engine until it is at operating temperature. Check the level of engine coolant in the reserve tank. When the engine is running and the engine coolant is at normal temperature, the coolant level in the tank should be at the FULL (HOT) mark **(Figure 4, (6)).** If the engine coolant is not at the FULL (HOT) mark **(Figure 4, (6))**, add additional engine coolant to the reserve tank to bring the level to the FULL (HOT) mark.

Daily Check of the Cooling System

1. Check the level of engine coolant in the reserve tank. When the engine is cold, the level in the tank should be at or slightly below the LOW COLD mark **(Figure 4, (4)).**
2. Add additional engine coolant to the reserve tank if necessary.
3. Check the radiator hoses for cracks, abrasions, cuts or other damage. Replace as necessary.

Engine Coolant Capacity (Typical)

The following are the engine coolant capacities for various Yanmar TNV engines.

Engine Model	Engine Coolant Capacity
3TNV82A	1.9 qt (1.8 L)
3TNV84, 3TNV84T	2.1 qt (2.0 L)
3TNV88	2.1 qt (2.0 L)
4TNV84, 4TNV84T	2.9 qt (2.7 L)
4TNV88	2.9 qt (2.7 L)
4TNV94L	4.4 qt (4.2 L)
4TNV98, 4TNV98T	4.4 qt (4.2 L)
4TNV106, 4TNV106T	6.3 qt (6.0 L)

Note: Capacities listed are for the engine only without a radiator. Refer to the operation manual provided by the driven machine manufacturer for actual engine coolant capacity on your machine.

DAILY CHECKS

Before you begin any job, make sure the Yanmar TNV engine is in good operating condition. Make sure you check the following items before you start your shift and have any repairs completed before you start work.

⚠ WARNING

HIGH PRESSURE HAZARD!

- **Avoid skin contact with high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray obtain prompt medical treatment.**
- **NEVER check for a fuel leak with your hands. ALWAYS use a piece of wood or cardboard. Have your authorized Yanmar industrial engine dealer or distributor repair the damage.**
- **Failure to comply could result in death or serious injury.**

CAUTION

Make it a habit to perform daily checks. ***See Daily Checks on page 41.***

Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor machine performance and helps extend the life of the engine.

Visual Checks

1. Check for engine oil leaks.
2. Check for fuel leaks.
3. Check for engine coolant leaks.
4. Check for damaged or missing parts.
5. Check for loose, missing, or damaged fasteners.
6. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.
7. Check hoses for cracks, abrasions, and damaged, loose or corroded clamps.
8. Check and clean radiator fins as necessary. *See Check and Clean Radiator Fins on page 81.*
9. Check the fuel filter / water separator for presence of water and contaminants. If you find any water or contaminants, drain the fuel filter / water separator. *See Drain Fuel Filter / Water Separator on page 76.* If you have to drain the fuel filter / water separator frequently, drain the fuel tank. *See Drain Fuel Tank on page 79.*

CAUTION

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

Check Diesel Fuel, Engine Oil, and Engine Coolant Levels

Follow the procedures in *Diesel Fuel on page 33*, *Engine Oil on page 37* and *Engine Coolant on page 39* to check these levels.

Check Engine Speed Control

1. Check the engine speed control for smooth operation and lubricate or clean as necessary.
2. Check engine speed control for proper adjustments.

Check Operator's Console

Before you operate the engine you should make sure that all of the indicators are functioning properly.

Check Indicators

Note that Yanmar TNV engines are available with various operator's consoles. Two typical operator's consoles are illustrated here.

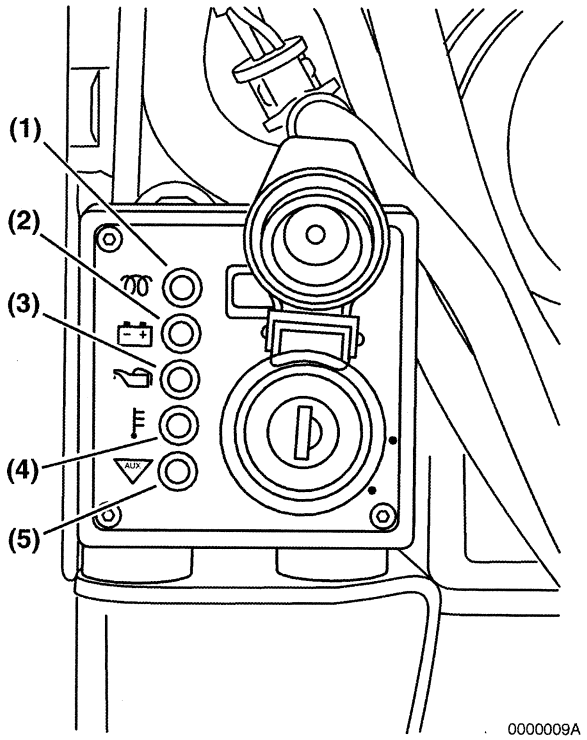


Figure 5

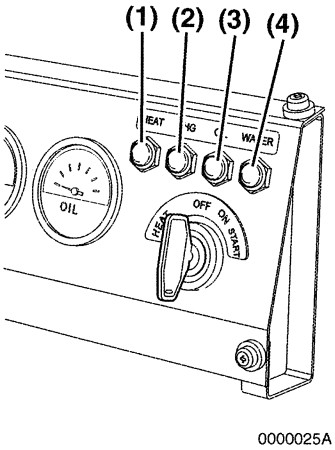


Figure 6

Pre-Heat - (Figure 5, (5)) - The pre-heat function is automatically activated when the key switch is turned to the ON position. The indicator flashes for several seconds and when it goes out you can turn the key switch to START.

Heat - (Figure 6, (1)) - Note that you must turn the key to the HEAT position to activate the inlet air heater. The indicator will flash for several seconds when you turn the key to HEAT. You can turn the key to START when the indicator goes out.

Battery - (Figure 5, (2)) or **(Figure 6, (2))** - Stays On until the engine is running and the alternator is supplying charging current. This indicator does not indicate whether the battery is discharged.

Engine Oil Pressure - (Figure 5, (6)) or **(Figure 6, (3))** - Stays On until the engine is running and the oil pressure is within normal limits.

Engine Coolant Temperature - (Figure 5, (4)) or **(Figure 6, (4))** - Stays On momentarily. Comes back On if engine overheats.

Auxiliary - (Figure 5, (1)) - Stays On momentarily. Used for special applications.

Here is a summary of how these indicators function. The table shows what happens when you turn the key in a certain direction (e.g., OFF to ON).

Indicator	OFF to HEAT	OFF to ON	START to ON
Pre-Heat/Heat	Lights for several seconds then goes out. Only for certain operator's consoles. **(Figure 6)**	Lights for several seconds then goes out. Only for certain operator's consoles. **(Figure 5)**	OFF
Battery	NA	ON	OFF (Stays On until alternator is supplying charging current. Remains On if there is a problem in the charging system. This indicator does not indicate whether the battery is discharged.)
Engine Oil Pressure	NA	ON	OFF (Stays On until oil pressure reaches normal operating pressure. Remains On, or comes back On, if there is a problem in the lubrication system.)
Engine Coolant Temperature	NA	ON	OFF (Stays On momentarily. Comes back On if there is a problem in the cooling system.)

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ENGINE OPERATION

This section of the *Operation Manual* describes the procedures for starting the engine, checking engine performance during operation, and shutting the engine down.

CAUTION

NEVER permit anyone to operate the engine or driven machine without proper training.

- **Read and understand this Operation Manual before you operate the machine to ensure that you follow safe operating practices and maintenance procedures.**
- **Machine safety signs and labels are additional reminders for safe operating and maintenance techniques.**
- **See your authorized Yanmar industrial engine dealer or distributor for additional training.**

⚠ DANGER

SCALD HAZARD!

- **NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.**
- **Securely tighten the radiator cap after you check the radiator. Steam can spurt out during engine operation if the cap is loose.**
- **ALWAYS check the level of engine coolant by observing the reserve tank.**
- **Failure to comply will result in death or serious injury.**

⚠ DANGER

EXPLOSION HAZARD!

- Keep the area around the battery well ventilated. While the engine is running or the battery is charging, hydrogen gas is produced which can be easily ignited.
- Keep sparks, open flame and any other form of ignition away.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Only use the key switch to start the engine.
- NEVER jump start the engine. Sparks caused by jumping the battery to the starter terminals may cause a fire or explosion.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- NEVER remove the fuel cap with engine running.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Only fill fuel tank with diesel fuel. Filling fuel tank with gasoline may result in a fire.
- NEVER refuel with engine running.
- Wipe up all spills immediately.
- Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) away when fueling / refueling.
- NEVER overfill the fuel tank.
- Fill fuel tank and store fuel in a well-ventilated area only.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Be sure to place the diesel fuel container on the ground when transferring diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity build-up which could cause sparks and ignite fuel vapors.
- NEVER place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shut down.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 2000 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 2000 hours of engine operation, whichever comes first.
- Failure to comply will result in death or serious injury.

⚠ WARNING

SEVER HAZARD!

- Keep hands and other body parts away from moving / rotating parts such as the cooling fan, flywheel or PTO shaft.
- Wear tight fitting clothing and keep your hair short or tie it back while the engine is running.
- Remove all jewelry before you operate or service the machine.
- NEVER start the engine in gear. Sudden movement of the engine and / or machine could cause death or serious personal injury.
- NEVER operate the engine without the guards in place.
- Before you start the engine make sure that all bystanders are clear of the area.
- Keep children and pets away while the engine is operating.
- Check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.
- Failure to comply could result in death or serious injury.

⚠ WARNING

EXHAUST HAZARD!

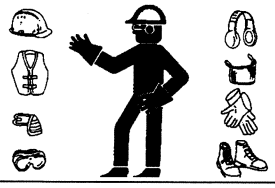
- NEVER operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.
- NEVER block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation. Accumulation of this gas within an enclosure could cause illness or even death.
- Make sure that all connections are tightened to specifications after repair is made to the exhaust system.
- Failure to comply could result in death or serious injury.

⚠ WARNING

ALCOHOL AND DRUG HAZARD!

- NEVER operate the engine while you are under the influence of alcohol or drugs.
- NEVER operate the engine when you are feeling ill.
- Failure to comply could result in death or serious injury.

⚠ WARNING



EXPOSURE HAZARD!

- Wear personal protective equipment such as gloves, work shoes, eye and hearing protection as required by the task at hand.
- NEVER wear jewelry, unbuttoned cuffs, ties or loose fitting clothing when you are working near moving / rotating parts such as the cooling fan, flywheel or PTO shaft.
- ALWAYS tie long hair back when you are working near moving / rotating parts such as a cooling fan, flywheel, or PTO shaft.
- NEVER operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear warning signals.
- Failure to comply could result in death or serious injury.

⚠ WARNING

SUDDEN MOVEMENT HAZARD!

- Allow the engine to warm-up for at least 5 minutes to allow the engine idle speed to return to normal before engaging the transmission or any PTO attachments. Engaging the transmission or PTO at an elevated engine speed could result in an unexpected movement of the equipment.
- Failure to comply could result in death or serious injury.

⚠ WARNING

BURN HAZARD!

- Keep your hands, and other body parts, away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.
- Failure to comply could result in death or serious injury.

CAUTION

NEVER use an engine starting aid such as ether. Engine damage will result.

CAUTION

For maximum engine life, Yanmar recommends that when shutting the engine down, you allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.

CAUTION

Make sure the engine is installed on a level surface. If a continuously running engine is installed at an angle greater than 30° (in any direction) or if an engine runs for short periods of time (less than 3 minutes) at an angle greater than 35° (in any direction) engine oil may enter the combustion chamber causing exessive engine speed and generate white smoke. This may cause serious engine damage.

CAUTION

New Engine Break In:

- On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, coolant leaks, and for proper operation of the indicators and / or gauges.
- During the first hour of operation, vary the engine speed and load on the engine. Short periods of maximum engine speed and load are desirable. Avoid prolonged operation at minimum or maximum engine speeds and loads for the next 4 to 5 hours.
- During the break-in period, carefully observe the engine oil pressure and engine temperature.
- During the break-in period, check the engine oil and coolant levels frequently.

CAUTION

NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

CAUTION

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- Avoid operating in extremely dusty conditions.
- Avoid operating in the presence of chemical gases or fumes.
- Avoid operating in a corrosive atmosphere such as salt water spray.
- NEVER install the engine in a floodplain unless proper precautions are taken to avoid being subject to a flood.
- NEVER expose the engine to the rain.

CAUTION

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- **NEVER run the engine if the ambient temperature is above +113°F (+45°C) or below +5°F (-15°C).**
  - **If the ambient temperature exceeds +113°F (+45°C) the engine may overheat and cause the engine oil to break down.**
  - **If the ambient temperature falls below +5°F (-15°C) rubber components such as gaskets and seals will harden causing premature engine wear and damage.**
  - **Contact your authorized Yanmar industrial engine dealer or distributor if the engine will be operated in either temperature extreme.**
- **Contact your authorized Yanmar industrial engine dealer or distributor if you need to operate the engine at high altitudes. At high altitudes the engine will lose power, run rough, and produce exhaust gases that exceed the design specifications.**

CAUTION

NEVER engage the starter motor while the engine is running. This may damage the starter motor pinion and / or ring gear.

STARTING ENGINE

Use the following procedure to start the engine. Note that two typical operator's consoles are shown for illustrative purposes only.

1. Make sure you follow the procedures stated in the *Daily Checks on page 41*.
2. Make sure the fuel filter / water separator fuel cock **(Figure 1, (1))** is in the ON position **(Figure 1, (2))**.

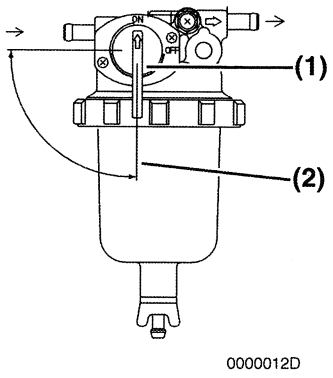


Figure 1

3. Set the transmission (if equipped) in the NEUTRAL position.
4. Disengage the PTO (if equipped).
5. Set the engine speed control to the mid-position.

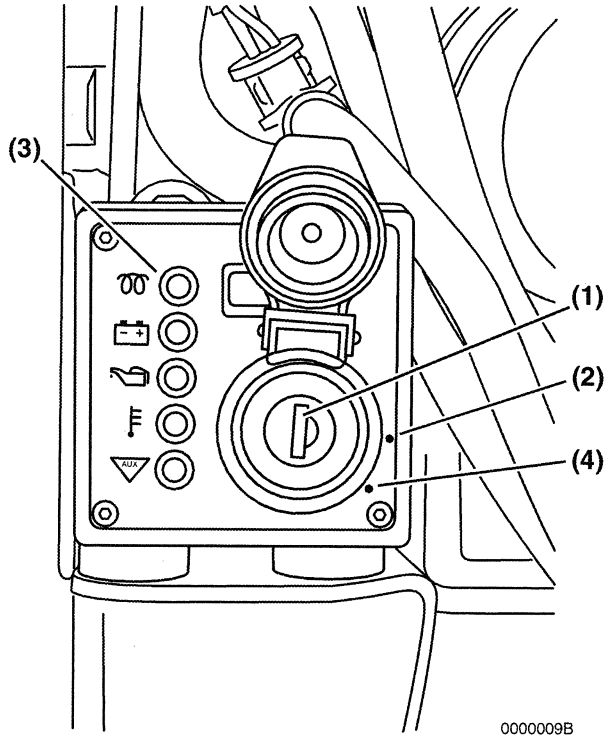


Figure 2

CAUTION

NEVER use an engine starting aid such as ether. Engine damage will result.

6. Insert the key **(Figure 2, (1))** or **(Figure 3, (1))** into the key switch.
7. Turn the key to the ON position **(Figure 2, (2))** or the HEAT position **(Figure 3, (2))**. The Pre-Heat indicator **(Figure 2, (3))** or Heat indicator **(Figure 3, (3))** flashes for several seconds and then goes out. After the Pre-Heat / Heat indicator goes out you can start the engine.

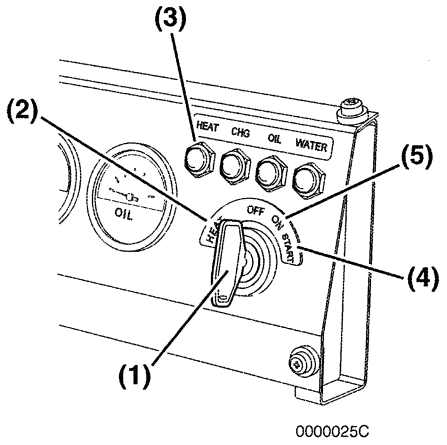


Figure 3

CAUTION

NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

8. Turn the key clockwise to the START position **(Figure 2, (4))** or **(Figure 3, (4))**. Release the key as soon as the engine starts. It will return to the ON position **(Figure 2, (2))** or **(Figure 3, (5))**.
9. If the engine fails to start:
   (a) Wait until the engine comes to a complete stop before you attempt to start it again. Engaging the starter while the engine is still rotating will result in damage to the starter and flywheel.
   (b) Wait at least 30 seconds before you attempt to start the engine again.This procedure will allow the battery voltage to recover and prevent damage to the starter motor due to the low battery voltage.

COLD START DEVICE

⚠ WARNING

SUDDEN MOVEMENT HAZARD!

- **Allow the engine to warm-up for at least 5 minutes to allow the engine idle speed to return to normal before engaging the transmission or any PTO attachments. Engaging the transmission or PTO at an elevated engine speed could result in an unexpected movement of the equipment.**
- **Failure to comply could result in death or serious injury.**

- The Cold Start Device improves engine starting at lower temperatures.
- If the engine cooling system temperature is below 41°F (5°C), the Cold Start Device automatically advances the fuel injection timing and slightly increases the fuel injection volume.
- The engine idle speed will be slightly elevated for approximately the first 5 minutes of operation.
- When the Cold Start Device is activated, you may notice a slight increase in the amount of exhaust smoke; this is normal.
- NEVER engage the transmission or PTO while the Cold Start Device is activated or unexpected movement of the machine may result.

CHECKING THE ENGINE DURING OPERATION

CAUTION

Make sure the engine is installed on a level surface. If a continuously running engine is installed at an angle greater than 30° (in any direction) or if an engine runs for short periods of time (less than 3 minutes) at an angle greater than 35° (in any direction) engine oil may enter the combustion chamber causing exessive engine speed and generate white smoke. This may cause serious engine damage.

CAUTION

New Engine Break In:

- **On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, coolant leaks, and for proper operation of the indicators and / or gauges.**
- **During the first hour of operation, vary the engine speed and load on the engine. Short periods of maximum engine speed and load are desirable. Avoid prolonged operation at minimum or maximum engine speeds and loads for the next 4 to 5 hours.**
- **During the break-in period, carefully observe the engine oil pressure and engine temperature.**
- **During the break-in period, check the engine oil and coolant levels frequently.**

CAUTION

NEVER engage the starter motor while the engine is running. This may damage the starter motor pinion and / or ring gear.

1. While the engine is running, check the gauges for normal indications. The gauges shown in **Figure 4** and **Figure 5** are provided for illustrative purposes only.

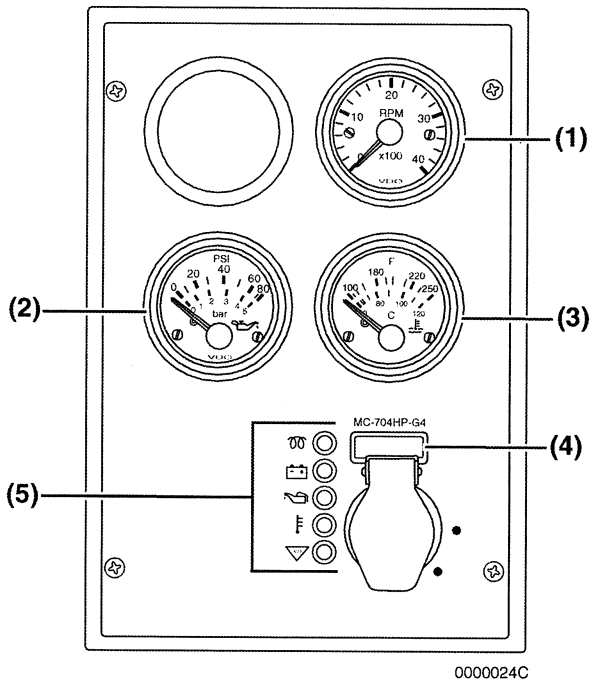


Figure 4

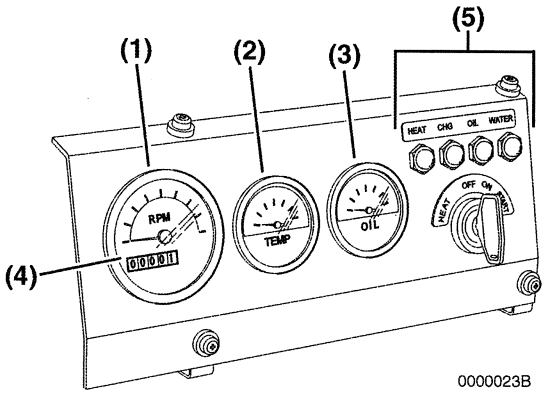


Figure 5

- **Tachometer** - **(Figure 4, (1))** or **(Figure 5, (1))** Make sure the engine speed is within normal limits. *See Engine Speed Specifications on page 99.*
- **Engine Oil Pressure** - **(Figure 4, (2))** or **(Figure 5, (3))** Make sure the engine oil pressure is within normal limits.
- **Engine Coolant Temperature** - **(Figure 4, (3))** or **(Figure 5, (2))** Make sure the engine coolant temperature is within normal limits.
- **Hour Meter** - The hour meter display **(Figure 4, (4))** or **(Figure 5, (4))** shows the total number of hours the engine has run. This is useful for planning periodic maintenance operations. *See Periodic Maintenance Schedule on page 71.*
- If any of the gauges shows an out of normal limits condition, shut down the engine and have the necessary repairs performed.

2. After the engine has reached operating temperature, all of the indicators **(Figure 4, (5))** or **(Figure 5, (5))** should be Off. If any of the indicators are On, shut down the engine and have the necessary repairs performed.

⚠ WARNING

HIGH PRESSURE HAZARD!

- **Avoid skin contact with high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray obtain prompt medical treatment.**
- **NEVER check for a fuel leak with your hands. ALWAYS use a piece of wood or cardboard. Have your authorized Yanmar industrial engine dealer or distributor repair the damage.**
- **Failure to comply could result in death or serious injury.**

3. Check for any fuel, engine coolant or engine oil leaks. If any leaks are found shut down the engine and have the necessary repairs performed.
4. Check for abnormal sounds or vibration. In some applications the engine and its mounting may start to resonate and cause unusual vibrations at certain engine speeds. Avoid running the engine at these speeds. If the abnormal sounds or vibration cannot be resolved, shut down the engine and have the necessary repairs performed.
5. Check for white or black smoke from the exhaust system. A small amount of white exhaust smoke is normal on start-up of a cold engine. Black exhaust smoke could mean the engine is overloaded or is being over-fueled. If either of these conditions persists, contact your authorized Yanmar industrial engine dealer or distributor.
6. Check the fuel level during operation. If the fuel level runs low, stop the engine and refuel.

ADJUST ENGINE SPEED

CAUTION

New Engine Break In:

- **On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, coolant leaks, and for proper operation of the indicators and / or gauges.**
- **During the first hour of operation, vary the engine speed and load on the engine. Short periods of maximum engine speed and load are desirable. Avoid prolonged operation at minimum or maximum engine speeds and loads for the next 4 to 5 hours.**
- **During the break-in period, carefully observe the engine oil pressure and engine temperature.**
- **During the break-in period, check the engine oil and coolant levels frequently.**

Use the engine speed control to adjust the engine speed for the task that will be performed.

SHUTTING DOWN THE ENGINE

CAUTION

For maximum engine life, Yanmar recommends that when shutting the engine down, you allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.

Follow these steps to shut down the engine:

1. Disengage the PTO and / or set the transmission to NEUTRAL.
2. Set the engine speed control to its lowest setting.
3. Run the engine at low idle speed for at least five minutes before you shut it down.

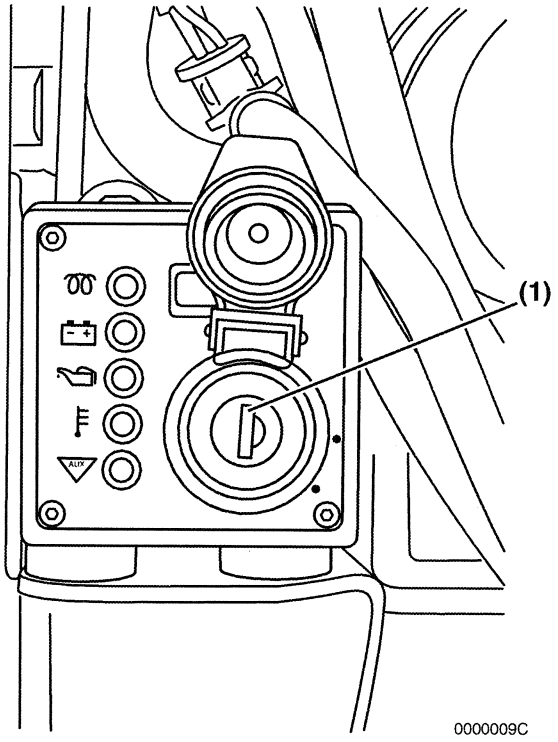


Figure 6

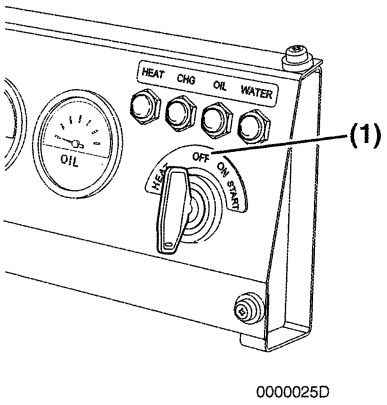


Figure 7

4. Turn the key to the OFF position **(Figure 6, (1))** or **(Figure 7, (1))** and remove it from the key switch.
5. If the engine will not be used for six months or longer, follow the additional instructions in *Long Term Storage on page 97*.

PERIODIC MAINTENANCE

This section of the *Operation Manual* describes the procedures for proper care and maintenance of the engine.

CAUTION

NEVER permit anyone to operate the engine or driven machine without proper training.

- **Read and understand this Operation Manual before you operate the machine to ensure that you follow safe operating practices and maintenance procedures.**
- **Machine safety signs and labels are additional reminders for safe operating and maintenance techniques.**
- **See your authorized Yanmar industrial engine dealer or distributor for additional training.**

⚠ DANGER

EXPLOSION HAZARD!

- **NEVER check the remaining battery charge by shorting out the terminals. This will result in a spark and may cause an explosion or fire. Use a hydrometer to check the remaining battery charge.**
- **If the electrolyte is frozen, slowly warm the battery before you recharge it.**
- **Failure to comply will result in death or serious injury.**

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Only use the key switch to start the engine.
- NEVER jump start the engine. Sparks caused by jumping the battery to the starter terminals may cause a fire or explosion.
- Failure to comply will result in death or serious injury.

⚠ DANGER

SCALD HAZARD!

- NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.
- Securely tighten the radiator cap after you check the radiator. Steam can spurt out during engine operation if the cap is loose.
- ALWAYS check the level of engine coolant by observing the reserve tank.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Only fill fuel tank with diesel fuel. Filling fuel tank with gasoline may result in a fire.
- NEVER refuel with engine running.
- Wipe up all spills immediately.
- Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) away when fueling / refueling.
- NEVER overfill the fuel tank.
- Fill fuel tank and store fuel in a well-ventilated area only.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Be sure to place the diesel fuel container on the ground when transferring diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity build-up which could cause sparks and ignite fuel vapors.
- NEVER place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shut down.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- NEVER remove the fuel cap with engine running.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 2000 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 2000 hours of engine operation, whichever comes first.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- NEVER use diesel fuel as a cleaning agent.
- Failure to comply will result in death or serious injury.

⚠ DANGER

CRUSH HAZARD!

- When you need to transport an engine for repair have a helper assist you attach it to a hoist and load it on a truck.
- NEVER stand under hoisted engine. If the hoist mechanism fails, the engine will fall on you, causing serious injury or death.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.
- NEVER use a shop rag to catch the fuel. Vapors from the rag are extremely flammable and explosive.
- Wipe up any spills immediately.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.
- Failure to comply will result in death or serious injury.

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is extremely flammable and explosive under certain conditions.
- Place an approved container under the air bleed port when you prime the fuel system. Never use a shop rag to catch the fuel. Wipe up any spills immediately. ALWAYS close the air bleed port after you complete priming the system.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you open the air bleed port.
- If the unit has an electric fuel pump, turn the key switch to the ON position for 10 to 15 seconds, or until the fuel coming out of the air bleed port is free of bubbles, to allow the electric fuel pump to prime the system.
- If the unit has a mechanical fuel pump, operate the fuel priming pump several times until the fuel coming out of the air bleed port is free of bubbles.
- Failure to comply will result in death or serious injury.

⚠ WARNING

EXHAUST HAZARD!

- NEVER operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.
- NEVER block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation. Accumulation of this gas within an enclosure could cause illness or even death.
- Make sure that all connections are tightened to specifications after repair is made to the exhaust system.
- Failure to comply could result in death or serious injury.

⚠ WARNING

SEVER HAZARD!

- Keep hands and other body parts away from moving / rotating parts such as the cooling fan, flywheel or PTO shaft.
- Wear tight fitting clothing and keep your hair short or tie it back while the engine is running.
- Remove all jewelry before you operate or service the machine.
- NEVER start the engine in gear. Sudden movement of the engine and / or machine could cause death or serious personal injury.
- NEVER operate the engine without the guards in place.
- Before you start the engine make sure that all bystanders are clear of the area.
- Keep children and pets away while the engine is operating.
- Check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.
- Failure to comply could result in death or serious injury.

⚠ WARNING

SUDDEN MOVEMENT HAZARD!

- Allow the engine to warm-up for at least 5 minutes to allow the engine idle speed to return to normal before engaging the transmission or any PTO attachments. Engaging the transmission or PTO at an elevated engine speed could result in an unexpected movement of the equipment.
- Failure to comply could result in death or serious injury.

⚠ WARNING

BURN HAZARD!

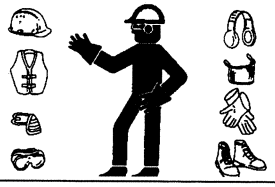
- Keep your hands, and other body parts, away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.
- Failure to comply could result in death or serious injury.

⚠ WARNING

ALCOHOL AND DRUG HAZARD!

- NEVER operate the engine while you are under the influence of alcohol or drugs.
- NEVER operate the engine when you are feeling ill.
- Failure to comply could result in death or serious injury.

⚠ WARNING



EXPOSURE HAZARD!

- Wear personal protective equipment such as gloves, work shoes, eye and hearing protection as required by the task at hand.
- NEVER wear jewelry, unbuttoned cuffs, ties or loose fitting clothing when you are working near moving / rotating parts such as the cooling fan, flywheel or PTO shaft.
- ALWAYS tie long hair back when you are working near moving / rotating parts such as a cooling fan, flywheel, or PTO shaft.
- NEVER operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear warning signals.
- Failure to comply could result in death or serious injury.

⚠ WARNING

BURN HAZARD!

- Batteries contain sulfuric acid. NEVER allow battery fluid to come in contact with clothing, skin or eyes. Severe burns could result. ALWAYS wear safety goggles and protective clothing when servicing the battery. If contact with the skin and / or eyes should occur, flush with a large amount of water and obtain prompt medical treatment.
- Failure to comply could result in death or serious injury.

⚠ WARNING

HIGH PRESSURE HAZARD!

- Avoid skin contact with high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray obtain prompt medical treatment.
- NEVER check for a fuel leak with your hands. ALWAYS use a piece of wood or cardboard. Have your authorized Yanmar industrial engine dealer or distributor repair the damage.
- Failure to comply could result in death or serious injury.

⚠ WARNING

SHOCK HAZARD!

- Turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the electrical system.
- Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors. ALWAYS keep the connectors and terminals clean.
- Failure to comply could result in death or serious injury.

⚠ WARNING

SEVER HAZARD!

- Stop the engine before you begin to service it.
- NEVER leave the key in the key switch when you are servicing the engine. Someone may accidentally start the engine and not realize you are servicing it. This could result in a serious injury.
- If you must service the engine while it is operating, remove all jewelry, tie back long hair, and keep your hands, other body parts and clothing away from moving / rotating parts.
- Failure to comply could result in death or serious injury.

⚠ WARNING

BURN HAZARD!

- If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being scalded. Make sure you wear eye protection.
- Failure to comply could result in death or serious injury.

⚠ CAUTION

FLYING OBJECT HAZARD!

- ALWAYS wear eye protection when servicing engine and when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.
- Failure to comply may result in minor or moderate injury.

CAUTION

- Only use diesel fuels recommended by Yanmar for the best engine performance, to prevent engine damage and to comply with EPA / ARB warranty requirements.
- Only use clean diesel fuel.
- NEVER remove primary strainer from the filler port. If removed, dirt and debris could get into the fuel system causing it to clog.

CAUTION

- Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.
- Prevent dirt and debris from contaminating engine oil. Carefully clean the oil cap / dipstick and the surrounding area before you remove the cap.
- NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.
- NEVER overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.

CAUTION

- Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal build up of rust and scale and / or shorten engine life.
- Prevent dirt and debris from contaminating engine coolant. Carefully clean the radiator cap and the surrounding area before you remove the cap.
- NEVER mix different types of engine coolants. This may adversely affect the properties of the engine coolant.

CAUTION

- NEVER attempt to modify the engine's design or safety features such as defeating the engine speed limit control or the diesel fuel injection quantity control.
- Modifications may impair the engine's safety and performance characteristics and shorten the engine's life. Any alterations to this engine may void its warranty. Be sure to use Yanmar genuine replacement parts.

CAUTION

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- Avoid operating in extremely dusty conditions.
- Avoid operating in the presence of chemical gases or fumes.
- Avoid operating in a corrosive atmosphere such as salt water spray.
- NEVER install the engine in a floodplain unless proper precautions are taken to avoid being subject to a flood.
- NEVER expose the engine to the rain.

CAUTION

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- NEVER run the engine if the ambient temperature is above +113°F (+45°C) or below +5°F (-15°C).
  - If the ambient temperature exceeds +113°F (+45°C) the engine may overheat and cause the engine oil to break down.
  - If the ambient temperature falls below +5°F (-15°C) rubber components such as gaskets and seals will harden causing premature engine wear and damage.
  - Contact your authorized Yanmar industrial engine dealer or distributor if the engine will be operated in either temperature extreme.
- Contact your authorized Yanmar industrial engine dealer or distributor if you need to operate the engine at high altitudes. At high altitudes the engine will lose power, run rough, and produce exhaust gases that exceed the design specifications.

CAUTION

NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

CAUTION

For maximum engine life, Yanmar recommends that when shutting the engine down, you allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.

CAUTION

NEVER use an engine starting aid such as ether. Engine damage will result.

CAUTION

Make sure the engine is installed on a level surface. If a continuously running engine is installed at an angle greater than 30° (in any direction) or if an engine runs for short periods of time (less than 3 minutes) at an angle greater than 35° (in any direction) engine oil may enter the combustion chamber causing exessive engine speed and generate white smoke. This may cause serious engine damage.

CAUTION

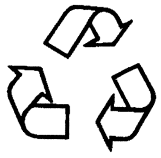
New Engine Break In:

- On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, coolant leaks, and for proper operation of the indicators and / or gauges.
- During the first hour of operation, vary the engine speed and load on the engine. Short periods of maximum engine speed and load are desirable. Avoid prolonged operation at minimum or maximum engine speeds and loads for the next 4 to 5 hours.
- During the break-in period, carefully observe the engine oil pressure and engine temperature.
- During the break-in period, check the engine oil and coolant levels frequently.

CAUTION

NEVER engage the starter motor while the engine is running. This may damage the starter motor pinion and / or ring gear.

CAUTION



Be responsible to the environment. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.

- Follow the guidelines of the EPA or other governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.

CAUTION

Protect the air cleaner, turbocharger (if equipped) and electric components from damage when you use steam or use high-pressure water to clean the engine.

CAUTION

- NEVER overfill the engine with engine oil.
- ALWAYS keep the oil level between upper and lower lines on the dipstick.

CAUTION

NEVER use high pressure water or compressed air at greater than 28 psi or a wire brush to clean the radiator fins. Radiator fins damage easily.

CAUTION

NEVER attempt to adjust the low or high idle speed limit screw. This may impair the safety and performance of the machine and shorten its life.

CAUTION

Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the engine's safety and performance characteristics, shorten the engine's life and may affect the warranty coverage on your engine. *See Yanmar Limited Warranty on page vii.*

Consult your authorized Yanmar industrial engine dealer or distributor for assistance when checking items marked with a ●.

CAUTION

If no water drips when the fuel filter / water separator drain cock is opened, loosen the air vent valve on the top of the fuel filter / water separator by using a screwdriver to turn it counterclockwise 2-3 turns.

This may occur if the fuel filter / water separator is positioned higher than the fuel level in the fuel tank. After draining the fuel filter / water separator, be sure to tighten the air vent screw.

CAUTION

- When the engine is operated in dusty conditions, clean the air cleaner element more frequently.
- NEVER operate the engine with the air cleaner or element removed. This may cause foreign material to enter the engine and damage it.

CAUTION

The maximum air intake restriction shall be 0.90 psi (6.23 kPa; 635 mm Aq) or less. Clean or replace the air cleaner element if the air intake restriction exceeds the above mentioned value.

CAUTION

The tightening torque in the Standard Torque Chart *(page 70)* should be applied only to the bolts with a "7" head. (JIS strength classification: 7T)

- Apply 60% torque to bolts that are not listed.
- Apply 80% torque when tightened to aluminum alloy.

CAUTION

Make it a habit to perform daily checks. *See Daily Checks on page 41.*

Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor machine performance and helps extend the life of the engine.

PRECAUTIONS

The Importance of Periodic Maintenance

Engine deterioration and wear occurs in proportion to length of time the engine has been in service and the conditions the engine is subject to during operation. Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor machine performance and helps extend the life of the engine.

Performing Periodic Maintenance

⚠ WARNING

EXHAUST HAZARD!

- **NEVER operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.**
- **NEVER block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation. Accumulation of this gas within an enclosure could cause illness or even death.**
- **Make sure that all connections are tightened to specifications after repair is made to the exhaust system.**
- **Failure to comply could result in death or serious injury.**

Perform periodic maintenance procedures in an open, level area free from traffic. If possible, perform the procedures indoors to prevent environmental conditions, such as rain, wind, or snow, from damaging the machine.

The Importance of Daily Checks

Periodic Maintenance Schedules assume that the daily checks are performed on a regular basis. Make it a habit of performing daily checks before the start of each shift. *See Daily Checks on page 41.*

Keep a Log of Engine Hours and Daily Checks

Keep a log of the number of hours the engine is run each day and a log of the daily checks performed. Also note the date, type of repair (e.g., replaced alternator), and parts needed for any service needed between the periodic maintenance intervals. Periodic maintenance intervals are every 50, 250, 500, 1000, 1500 and 2000 engine hours. Failure to perform periodic maintenance will shorten the life of the engine.

Yanmar Replacement Parts

Yanmar recommends that you use genuine Yanmar parts when replacement parts are needed. Genuine replacement parts help ensure long engine life.

Tools Required

Before you start any periodic maintenance procedure make sure you have the tools you need to perform all of the required tasks.

Ask Your Authorized Yanmar Industrial Engine Dealer or Distributor For Help

Our professional service technicians have the expertise and skills to help you with any maintenance or service related procedures you need help with.

Required EPA / ARB Maintenance - USA Only

To maintain optimum engine performance and compliance with the Environmental Protection Agency (EPA) Regulations Non-road Engines and the California Air Resources Board (ARB, California), it is essential that you follow the *Periodic Maintenance Schedule on page 71* and *Periodic Maintenance Procedures which start on page 73*.

EPA / ARB Installation Requirements - USA Only

The following are the installation requirements for the EPA / ARB. Unless these requirements are met, the exhaust gas emissions will not be within the limits specified by the EPA and ARB.

Maximum Exhaust Gas Restriction shall be:

- 3TNV84T and 4TNV84T: 0.85 psi (5.88 kPa; 600 mm Aq) or less
- 4TNV98T: 1.71 psi (11.77 kPa; 1200 mm Aq) or less
- 3TNV82A, 3TNV84, 3TNV88, 4TNV94, 4TNV88, 4TNV94L, and 4TNV98: 2.22 psi (15.3 kPa; 1560 mm Aq) or less

Maximum air intake restriction shall be 0.90 psi (6.23kPa; 635mm Aq) or less. Clean or replace the air cleaner element if the air intake restriction exceeds the above mentioned value.

Tightening Fasteners

Use the correct amount of torque when you tighten fasteners on the machine. Applying excessive torque may damage the fastener or component and not enough torque may cause a leak or component failure.

CAUTION

The tightening torque in the Standard Torque Chart *(page 70)* should be applied only to the bolts with a "7" head. (JIS strength classification: 7T)

- **Apply 60% torque to bolts that are not listed.**
- **Apply 80% torque when tightened to aluminum alloy.**

STANDARD TORQUE CHART

Thread size x Pitch mm		M6x1.0	M8x1.25	M10x1.5	M12x1.75	M14x1.5	M16x1.5
Tightening Torque	in lbs	96.0 ± 9.0	-	-	-	-	-
	ft lbs	-	19.0 ± 2.0	36.0 ± 4.0	65.0 ± 7.0	101.0 ± 7.0	167.0 ± 7.0
	N·m	10.8 ± 1.0	25.5 ± 2.9	49.0 ± 4.9	88.3 ± 9.8	137.0 ± 9.8	226.0 ± 9.8
	kgf·m	1.1 ± 0.1	2.6 ± 0.3	5.0 ± 0.5	9.0 ± 1.0	14.0 ± 1.5	23.0 ± 2.0

PERIODIC MAINTENANCE SCHEDULE

Daily and periodic maintenance is important to keep the engine in good operating condition. The following is a summary of maintenance items by periodic maintenance intervals. Periodic maintenance intervals vary depending on engine application, loads, diesel fuel and engine oil used and are hard to establish definitively. The following should be treated only as a general guideline.

CAUTION

Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the engine's safety and performance characteristics, shorten the engine's life and may affect the warranty coverage on your engine. ***See Yanmar Limited Warranty on page vii.***

Consult your authorized Yanmar industrial engine dealer or distributor for assistance when checking items marked with a ●.

PERIODIC MAINTENANCE

○: Check ◇: Replace ●: Contact your authorized Yanmar industrial engine dealer or distributor

System	Check Item	Daily	Periodic Maintenance Interval					
			Every 50 hours	Every 250 hours	Every 500 hours	Every 1000 hours	Every 1500 hours	Every 2000 hours
Cooling System	Check & Refill Engine Coolant	○						
	Check & Clean Radiator Fins			○				
	Check & Adjust Cooling Fan V-belt		○ 1st time	○ 2nd & after				
	Flush & Fill Engine Coolant					◇ or every 1 yr. which-ever comes first		
	Flush & Service Cooling System							●
Cylinder Head	Adjust Intake / Exhaust Valve Clearance					●		
	Lap Intake / Exhaust Valve Seats							●
Electrical Equipment	Check Indicators	○						
	Check Battery		○					
Engine Oil	Check Engine Oil Level	○						
	Drain & Fill Engine Oil		◇ 1st time	◇ 2nd & after				
	Replace Engine Oil Filter							
Engine Speed Control	Check & Adjust Governor Lever & Engine Speed Control	○		○				
Emission Control Warranty	Inspect, Clean & Test Fuel Injectors						●	
	Inspect & Clean Turbocharger (Blower Wash As Necessary)						●	
Fuel	Check & Refill Fuel Tank Level	○						
	Drain Fuel Tank			○				
	Drain Fuel Filter / Water Separator		○					
	Check Fuel Filter / Water Separator	○						
	Clean Fuel Filter / Water Separator				○			
	Replace Fuel Filter				◇			
Hoses	Replace Fuel System & Cooling System Hoses							● or every 2 yrs.
Intake & Exhaust	Clean or Replace Air Cleaner Element			○	◇			

PERIODIC MAINTENANCE PROCEDURES

After Initial 50 Hours of Operation

Perform the following maintenance after the initial 50 hours of operation.

- **Replace Engine Oil and Engine Oil Filter**
- **Check and Adjust Cooling Fan V-belt**

Replace Engine Oil and Engine Oil Filter

⚠ WARNING

BURN HAZARD!

- **If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being scalded. Make sure you wear eye protection.**
- **Failure to comply could result in death or serious injury.**

⚠ WARNING

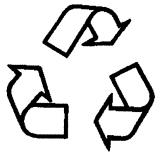
SUDDEN MOVEMENT HAZARD!

- **Allow the engine to warm-up for at least 5 minutes to allow the engine idle speed to return to normal before engaging the transmission or any PTO attachments. Engaging the transmission or PTO at an elevated engine speed could result in an unexpected movement of the equipment.**
- **Failure to comply could result in death or serious injury.**

CAUTION

- **Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.**
- **Prevent dirt and debris from contaminating engine oil. Carefully clean the oil cap / dipstick and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.**
- **NEVER overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.**

CAUTION



Be responsible to the environment. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.

- **Follow the guidelines of the EPA or other governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.**
- **NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**

The engine oil on a new engine becomes contaminated from the initial break-in of internal parts.

Drain the engine oil as follows:

1. Make sure the engine is level.
2. Start the engine and bring it up to operating temperature.
3. Stop the engine.
4. Remove the oil filler cap **(Figure 1, (1))** to vent the engine crankcase and allow the engine oil to drain more easily.
5. Position a container under the engine to collect waste oil.

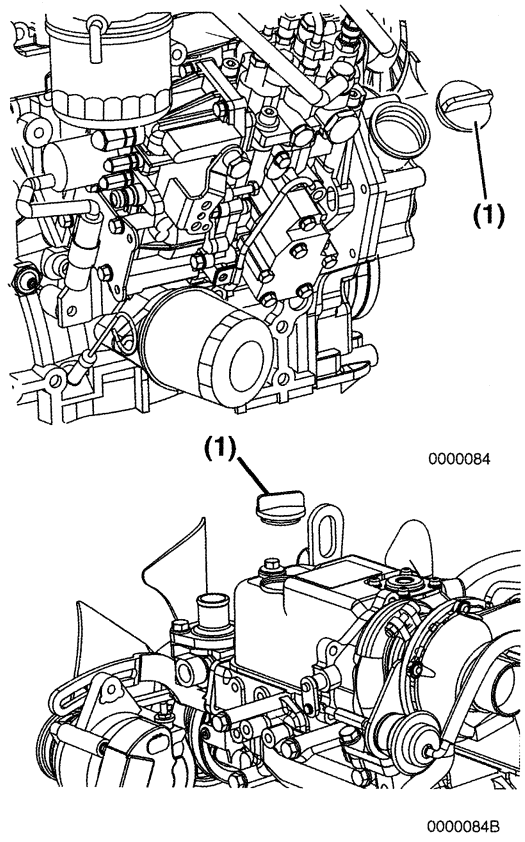


Figure 1

6. Remove the drain plug **(Figure 2, (1))**. Allow oil to drain.

   After all oil has been drained from the engine, install the drain plug **(Figure 2, (1))** and tighten to 14-17 ft lbs (19.6-23.5 N•m, 2.0-2.4 kgf•m).

7. Dispose of used oil properly.

Remove the engine oil filter as follows:

1. Turn the engine oil filter **(Figure 2, (2))** counterclockwise **(Figure 2, (3))** using a filter wrench.

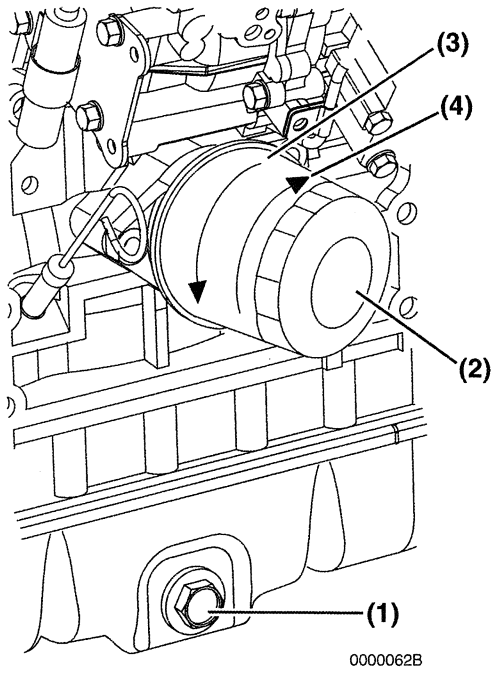


Figure 2

2. Clean the engine oil filter mounting face.
3. Lightly coat the gasket on the new oil filter with engine oil. Install the new engine oil filter manually by turning it clockwise **(Figure 2, (4))** until it contacts the mounting surface. Tighten an additional 3/4 of a turn using the filter wrench.

Applicable Engine Oil Filter Part No.	
All models except 4TNV106, 4TNV106T	129150-35152
4TNV106, 4TNV106T	119005-35100

4. Add new engine oil to the engine as specified in *Adding Engine Oil on page 38*.

CAUTION
• **NEVER overfill the engine with engine oil.** • **ALWAYS keep the oil level between upper and lower lines on the dipstick.**

5. Warm up the engine by running it for 5 minutes and check for any engine oil leaks.
6. After engine is warm, shut it off and let it sit for 10 minutes.

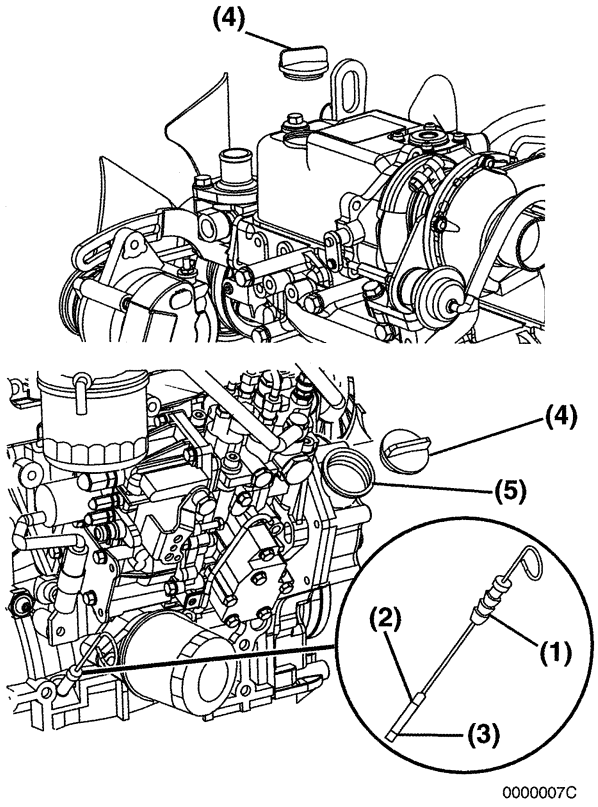


Figure 3

7. Recheck the engine oil level.
8. Add engine oil **(Figure 3, (5))** as needed until the level is between the upper **(Figure 3, (2))** and lower lines **(Figure 3, (3))** shown on the dipstick **(Figure 3, (1))**.
9. Replace the oil filler cap **(Figure 3, (4))**. If any engine oil is spilled, wipe it away with a clean cloth.

Check and Adjust Cooling Fan V-belt

The V-belt will slip if it does not have the proper tension. This will prevent the alternator from generating sufficient power. Also, the engine will overheat due to the engine coolant pump pulley slipping.

Check and adjust the V-belt tension (deflection) as follows:

1. Press the V-belt down with your thumb with a force of approximately 22 ft lbs (98 N•m,10 kgf) to check the deflection.

   There are three positions to check for V-belt tension **(Figure 4, (A), (B) and (C))**. You can check the tension at whichever position is the most accessible. The proper deflection of a used V-belt at each position is:

Used V-belt Tension		
A	**B**	**C**
3/8 ~1/2 in (10~14 mm)	1/4 ~3/8 in (7~10 mm)	5/16 ~1/2 in (9~13 mm)

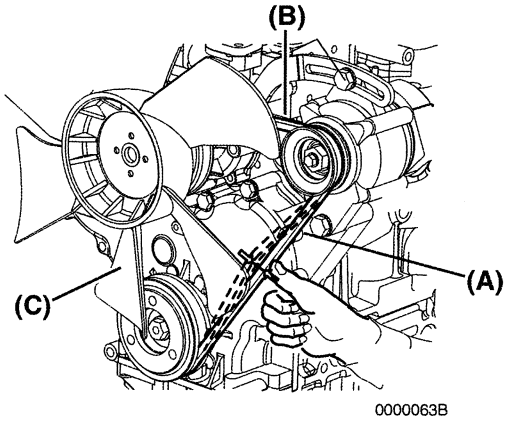


Figure 4

2. If necessary, adjust the V-belt tension. Loosen the set bolt **(Figure 5, (1))** and move the alternator **(Figure 5, (2))** with a pry bar **(Figure 5, (3))** to tighten the V-belt.

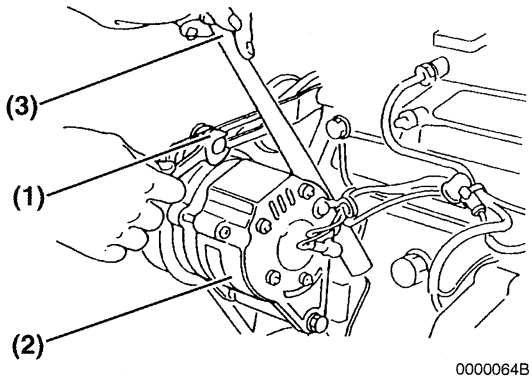


Figure 5

3. Check the V-belt for cracks, oil or wear. If any of these conditions exists, replace the V-belt.
   - "New V-belt" refers to a V-belt which has been used less than 5 minutes on a running engine.
   - "Used V-belt" refers to a V-belt which has been used on a running engine for 5 minutes or more.

   Install the new V-belt. Refer to the table for proper tension. After adjusting, run the engine for 5 minutes and check the tension again.

New V-belt Tension		
A	B	C
5/16 ~7/16 in (8~12 mm)	3/16 ~5/16 in (5~8 mm)	1/4 ~7/16 in (7~11 mm)

Every 50 Hours of Operation

After you complete the initial 50 hour maintenance procedures, perform the following procedures every 50 hours thereafter.

- **Drain Fuel Filter / Water Separator**
- **Check Battery**

Drain Fuel Filter / Water Separator

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

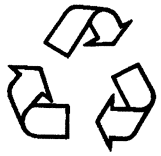
- **Diesel fuel is extremely flammable and explosive under certain conditions.**
- **When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.**
- **NEVER use a shop rag to catch the fuel. Vapors from the rag are extremely flammable and explosive.**
- **Wipe up any spills immediately.**
- **Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.**
- **Failure to comply will result in death or serious injury.**

CAUTION

If no water drips when the fuel filter / water separator drain cock is opened, loosen the air vent valve on the top of the fuel filter / water separator by using a screwdriver to turn it counterclockwise 2-3 turns.

This may occur if the fuel filter / water separator is positioned higher than the fuel level in the fuel tank. After draining the fuel filter / water separator, be sure to tighten the air vent screw.

CAUTION



Be responsible to the environment. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.

- **Follow the guidelines of the EPA or other governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.**
- **NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**

Drain the fuel filter / water separator whenever there are contaminants, such as water, collected in the bottom of the cup. NEVER wait until the scheduled periodic maintenance if contaminants are discovered.

The cup of the separator is made from semi-transparent material. In the cup is a red colored float ring. The float ring will rise to the surface of the water to show how much needs to be drained. Also, some optional fuel filter / water separators are equipped with a sensor to detect the amount of contaminants. This sensor sends a signal to an indicator to alert the operator.

Drain the fuel filter / water separator as follows:

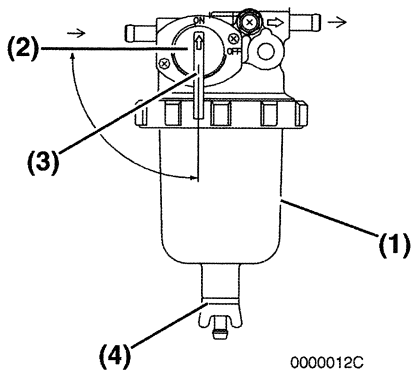


Figure 6

1. Position an approved container under the fuel filter / water separator **(Figure 6, (1))** to collect the contaminants.
2. Close **(Figure 6, (2))** the fuel cock **(Figure 6, (3))**.
3. Loosen the drain cock **(Figure 6, (4))** at the bottom of the fuel filter/water separator. Drain any water collected inside.
4. Hand tighten the drain cock.
5. Be sure to prime the diesel fuel system when you are done. *See Priming The Fuel System on page 36.*

Check Battery

⚠ DANGER

EXPLOSION HAZARD!

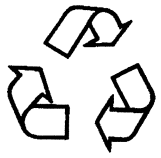
- **NEVER check the remaining battery charge by shorting out the terminals. This will result in a spark and may cause an explosion or fire. Use a hydrometer to check the remaining battery charge.**
- **If the electrolyte is frozen, slowly warm the battery before you recharge it.**
- **Failure to comply will result in death or serious injury.**

⚠ WARNING

BURN HAZARD!

- **Batteries contain sulfuric acid. NEVER allow battery fluid to come in contact with clothing, skin or eyes. Severe burns could result. ALWAYS wear safety goggles and protective clothing when servicing the battery. If contact with the skin and / or eyes should occur, flush with a large amount of water and obtain prompt medical treatment.**
- **Failure to comply could result in death or serious injury.**

CAUTION



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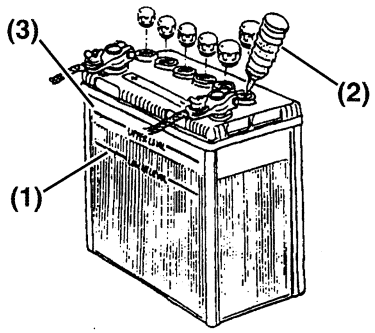


Figure 7

- When the amount of fluid nears the lower limit **(Figure 7, (1))**, fill with distilled water **(Figure 7, (2))** so it is at the upper limit **(Figure 7, (3))**. If operation continues with insufficient battery fluid, the battery life is shortened, and the battery may overheat and explode. During the summer, check the fluid level more often than specified.

- If the engine cranking speed is so slow that the engine does not start, recharge the battery.
- If the engine still will not start after charging, have your authorized Yanmar industrial engine dealer or distributor check the battery and the engine's starting system.
- If operating the machine where the ambient temperature could drop to 5°F (-15°C) or less, remove the battery from the machine at the end of the day. Store the battery in a warm place until the next use. This will help start the engine easily at low ambient temperatures.

Every 250 Hours of Operation

Perform the following maintenance every 250 hours of operation.

- **Drain Fuel Tank**
- **Replace Engine Oil and Engine Oil Filter**
- **Check and Clean Radiator Fins**
- **Check and Adjust Cooling Fan V-belt**
- **Check and Adjust the Governor Lever and Engine Speed Control**
- **Clean Air Cleaner Element**

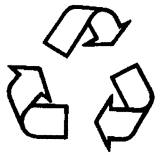
Drain Fuel Tank

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is extremely flammable and explosive under certain conditions.**
- **When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.**
- **NEVER use a shop rag to catch the fuel. Vapors from the rag are extremely flammable and explosive.**
- **Wipe up any spills immediately.**
- **Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.**
- **Failure to comply will result in death or serious injury.**

CAUTION



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- **Follow the guidelines of the EPA or other governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.**
- **NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**

Note that a typical fuel tank is illustrated.

1. Position an approved container under the diesel fuel tank **(Figure 8, (1))** to collect the contaminants.
2. Remove the fuel cap **(Figure 8, (3))**.
3. Loosen the drain plug **(Figure 8, (2))** of the fuel tank to drain the contaminants (water, dirt, etc.) from the bottom of the tank.
4. Drain the tank until clean diesel fuel with no water and dirt flows out. Tighten the drain plug firmly.

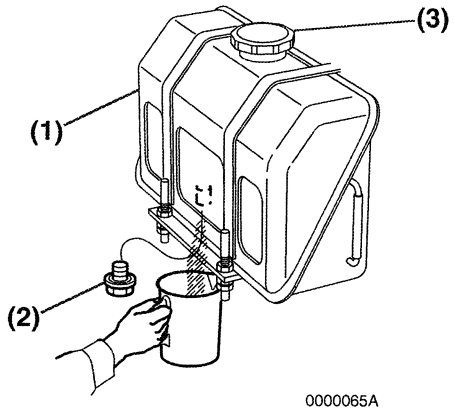


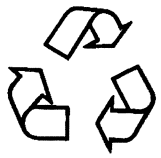
Figure 8

Replace Engine Oil and Engine Oil Filter

CAUTION

- **Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.**
- **Prevent dirt and debris from contaminating engine oil. Carefully clean the oil cap / dipstick and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.**
- **NEVER overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.**

CAUTION



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- **Follow the guidelines of the EPA or other governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.**
- **NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**

Change the engine oil every 250 hours of operation after the initial change at 50 hours. Replace the engine oil filter at the same time. *See Replace Engine Oil and Engine Oil Filter on page 73.*

Check and Clean Radiator Fins

⚠ CAUTION

FLYING OBJECT HAZARD!

- **ALWAYS wear eye protection when servicing engine and when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.**
- **Failure to comply may result in minor or moderate injury.**

Dirt and dust adhering to the radiator fins reduce the cooling performance, causing overheating. Make it a rule to check the radiator fins daily and clean as needed.

Note that a typical radiator is shown in **Figure 9** for illustrative purposes only.

- Blow off dirt and dust from fins and radiator with 28 psi (0.19 MPa, 2 kgf/cm^2) or less of compressed air **(Figure 9, (1))**. Be careful not to damage the fins with the compressed air.
- If there is a large amount of contamination on the fins, apply detergent, thoroughly clean and rinse with tap water.

CAUTION

NEVER use high pressure water or compressed air at greater than 28 psi or a wire brush to clean the radiator fins. Radiator fins damage easily.

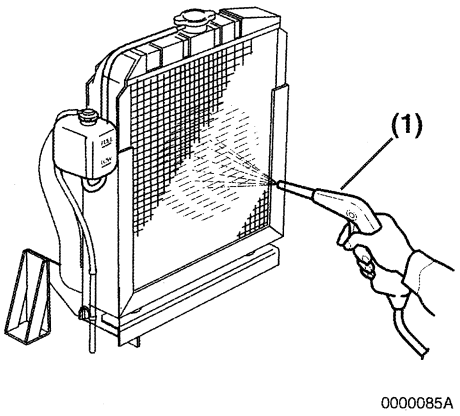


Figure 9

Check and Adjust Cooling Fan V-belt

Check and adjust the cooling fan V-belt every 250 hours of operation after the initial 50 hour V-belt maintenance. *See Check and Adjust Cooling Fan V-belt on page 75.*

Check and Adjust the Governor Lever and Engine Speed Control

The governor lever and engine speed control (accelerator lever, pedal, etc.) of the machine are connected together by an accelerator cable or rod. If the cable becomes stretched, or the connections loosen, the governor lever may not respond to change of engine speed control position. This may make operation of the machine unsafe. Check the cable periodically and adjust if necessary. Consult your authorized Yanmar industrial engine dealer or distributor for the adjustment procedure.

NEVER force the accelerator cable or pedal to move. This may deform the governor lever or stretch the cable and cause irregular operation of the engine speed control.

Checking and adjusting the governor lever:

1. Check that the governor lever **(Figure 10, (1))** makes uniform contact with the high idle **(Figure 10, (2))** and low idle **(Figure 10, (3))** speed limit screws when the engine speed control is in the high idle speed or low idle speed position.
2. If the governor lever does not make contact with the high idle or low idle speed limit screw, adjust the accelerator cable.
3. In some engine speed control applications, loosen the accelerator cable locknut **(Figure 10, (4))** and adjust the cable so the governor lever makes proper contact with the high / low idle speed limit screw.

CAUTION

NEVER attempt to adjust the low or high idle speed limit screw. This may impair the safety and performance of the machine and shorten its life.

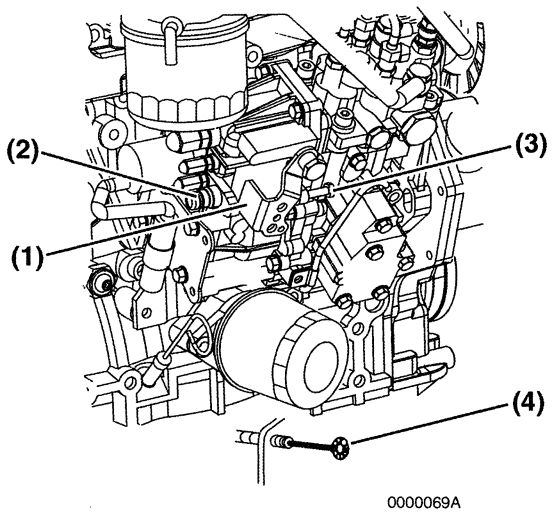


Figure 10

Clean Air Cleaner Element

Note that a typical air cleaner is shown in **Figure 11** and **Figure 12** for illustrative purposes only.

The engine performance is adversely affected when the air cleaner element is clogged with dust. Be sure to clean the air filter element periodically.

1. Unlatch and remove the air cleaner cover **(Figure 11, (1))**.
2. Remove the element **(Figure 11, (2))** (outer element if equipped with two elements).

⚠ CAUTION

FLYING OBJECT HAZARD!

- **ALWAYS wear eye protection when servicing engine and when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.**
- **Failure to comply may result in minor or moderate injury.**

3. Blow air **(Figure 11, (3))** through the element from the inside out using 42-71 psi (0.29–0.49 MPa, 3.0–5.0 kgf/cm^2) compressed air to remove the particulates. Use the lowest possible air pressure to remove the dust without damaging the element.

   If the air cleaner is equipped with a double element, *only remove and replace the inner element **(Figure 12, (1))** if the engine lacks power or the dust indicator actuates (if equipped).*

   The inner element should not be removed because it is used to prevent dust from entering the engine when cleaning or replacing the outer element.

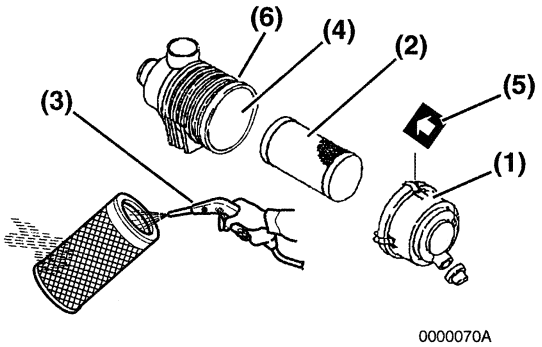


Figure 11

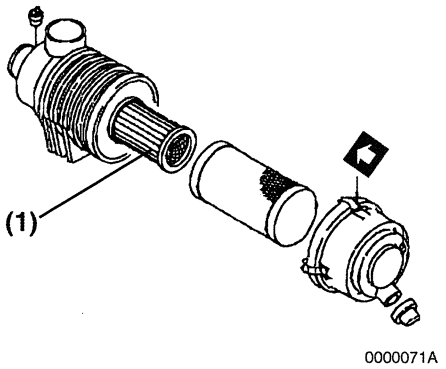


Figure 12

4. Replace the element with a new one if the element is damaged, excessively dirty or oily.
5. Clean inside of the air cleaner cover.
6. Install the element into the air cleaner case **(Figure 11, (4))**.
7. Install the air cleaner cover making sure you match the arrow **(Figure 11, (5))** on the cover with the arrow on the case **(Figure 11, (6))**.
8. Latch the air cleaner cover to the case.

CAUTION

- **When the engine is operated in dusty conditions, clean the air cleaner element more frequently.**
- **NEVER operate the engine with the air cleaner or element removed. This may cause foreign material to enter the engine and damage it.**

Every 500 Hours of Operation

Perform the following maintenance every 500 hours of operation.

- **Replace Air Cleaner Element**
- **Replace Fuel Filter**
- **Clean Fuel Filter / Water Separator**

Replace Air Cleaner Element

CAUTION

The maximum air intake restriction shall be 0.90 psi (6.23 kPa; 635 mm Aq) or less. Clean or replace the air cleaner element if the air intake restriction exceeds the above mentioned value.

Replace the air cleaner element **(Figure 11, (2))** every 500 hours even if it is not damaged or dirty.

When replacing the element, clean the inside of the air cleaner case **(Figure 11, (4))**.

If the air cleaner is equipped with a double element, *only remove and replace the inner element* ***(Figure 12, (1))*** *if the engine lacks power or the dust indicator actuates (if equipped).* This is in addition to replacing the outer element.

Replace Fuel Filter

⚠ DANGER

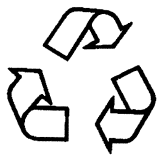
FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is extremely flammable and explosive under certain conditions.**
- **When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.**
- **NEVER use a shop rag to catch the fuel. Vapors from the rag are extremely flammable and explosive.**
- **Wipe up any spills immediately.**
- **Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.**
- **Failure to comply will result in death or serious injury.**

CAUTION

For maximum engine life, Yanmar recommends that when shutting the engine down, you allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.

CAUTION



Be responsible to the environment. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.

- **Follow the guidelines of the EPA or other governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.**
- **NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**

Replace the fuel filter at specified intervals to prevent contaminants from adversely affecting the diesel fuel flow.

1. Stop the engine and allow it to cool.
2. Close the fuel cock of the fuel filter / water separator.
3. Remove the fuel filter using a filter wrench to turn it to the left **(Figure 13, (1))**. When removing the fuel filter, carefully hold it to prevent the fuel from spilling. Wipe up all spilled fuel.

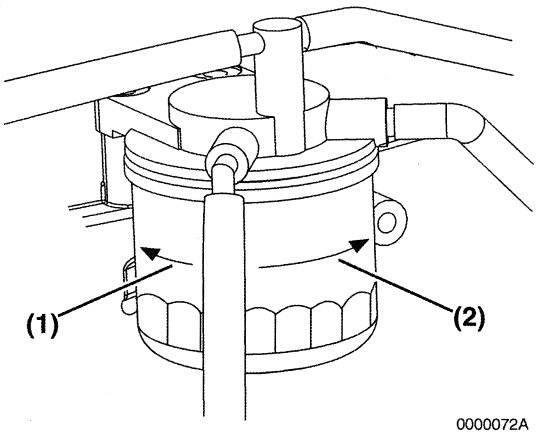


Figure 13

4. Clean the filter mounting surface and apply a small amount of diesel fuel to the gasket of the new fuel filter.
5. Install the new fuel filter. Hand tighten it to the right **(Figure 13, (2))** until it comes in contact with the mounting surface. Use a filter wrench to tighten it one additional turn.

Applicable Fuel Filter Part No.	
All models except 4TNV98T, 4TNV106, 4TNV106T	119802-55800
4TNV98T, 4TNV106, 4TNV106T	123907-55800

6. Prime the fuel system. *See Priming The Fuel System on page 36.*

Clean Fuel Filter / Water Separator

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

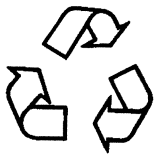
- **Diesel fuel is extremely flammable and explosive under certain conditions.**
- **NEVER use diesel fuel as a cleaning agent.**
- **Failure to comply will result in death or serious injury.**

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is extremely flammable and explosive under certain conditions.**
- **When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.**
- **NEVER use a shop rag to catch the fuel. Vapors from the rag are extremely flammable and explosive.**
- **Wipe up any spills immediately.**
- **Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.**
- **Failure to comply will result in death or serious injury.**

CAUTION



Be responsible to the environment. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.

- **Follow the guidelines of the EPA or other governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.**
- **NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**

Periodically clean the fuel filter / water separator element and inside cup.

1. Position an approved container under the cup **(Figure 14, (1))** of the fuel filter / water separator to collect the contaminants.
2. Close **(Figure 14, (2))** the fuel cock **(Figure 14, (3))**.
3. Loosen the drain cock **(Figure 14, (4))** and drain the contaminants. *See Drain Fuel Filter / Water Separator on page 76.*
4. Turn the retaining ring **(Figure 14, (5))** to the right **(Figure 14, (6))** and remove the cup **(Figure 14, (1))**. If equipped, disconnect the sensor wire **(Figure 14, (7))** from the cup before removing the cup.
5. Carefully hold the cup to prevent fuel from spilling. If you spill any fuel, clean up the spill completely.

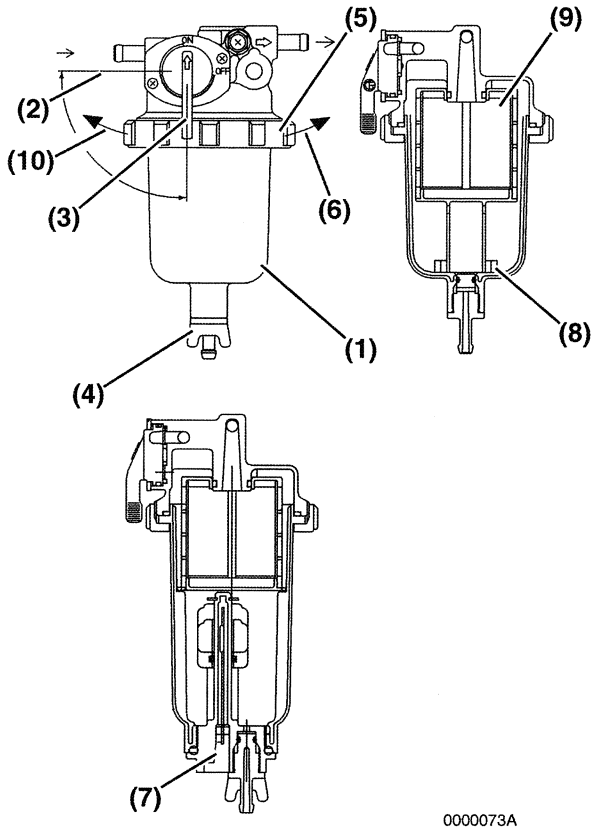


Figure 14

6. Remove the float ring **(Figure 14, (8))** from the cup. Pour the contaminants into the container and dispose of it properly.
7. Clean the element **(Figure 14, (9))** and inside cup. Replace the element if it is damaged.

Applicable Element Part No.	
All Models	119802-55710

8. Install the element and O-ring in the bracket.
9. Position the float ring in the cup.
10. Install the cup to the bracket by tightening the retaining ring to the left **(Figure 14, (10))** to a torque of 11-15 ft lbs (15-20 N•m, 1.5-2.0 kgf•m).
11. Close the drain cock. Connect the sensor wire if equipped.
12. Prime the fuel system. *See Priming The Fuel System on page 36.*

Every 1000 Hours of Operation

Perform the following maintenance every 1000 hours of operation.

- **Replace Engine Coolant**
- **Adjust Intake / Exhaust Valve Clearance**

Replace Engine Coolant

⚠ DANGER

SCALD HAZARD!

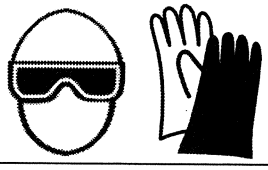
- **NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.**
- **Securely tighten the radiator cap after you check the radiator. Steam can spurt out during engine operation if the cap is loose.**
- **ALWAYS check the level of engine coolant by observing the reserve tank.**
- **Failure to comply will result in death or serious injury.**

⚠ WARNING

BURN HAZARD!

- **Wait until the engine cools before you drain the engine coolant. Hot engine coolant may splash and burn you.**
- **Failure to comply could result in death or serious injury.**

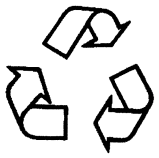
⚠ CAUTION



COOLANT HAZARD!

- **Wear eye protection and rubber gloves when you handle Long Life or Extended Life Engine Coolant. If contact with the eyes or skin should occur, wash with clean water.**
- **Failure to comply may result in minor or moderate injury.**

CAUTION



Be responsible to the environment. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.

- **Follow the guidelines of the EPA or other governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.**
- **NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**

Engine coolant contaminated with rust or scale reduces the cooling effect. Even when extended life engine coolant is properly mixed, the engine coolant gets contaminated as its ingredients deteriorate. Replace the engine coolant at least once a year.

1. Remove the radiator cap **(Figure 15, (1))**.
2. Loosen the drain plug **(Figure 15, (2))** at the lower portion of the radiator and drain the engine coolant.

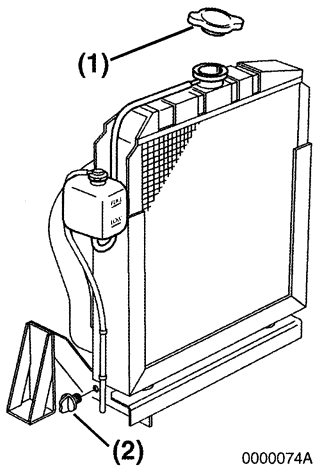


Figure 15

3. Drain the coolant from the engine block.
   - On models not equipped with an oil cooler, remove the coolant drain plug **(Figure 16, (1))** from the engine block.

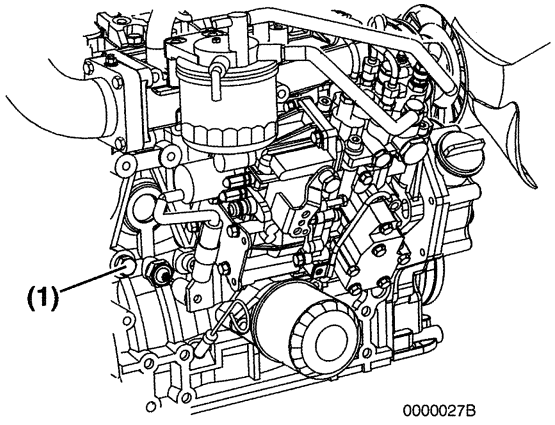


Figure 16

   - On models equipped with an oil cooler, remove the coolant hose **(Figure 17, (1))** at the oil cooler.

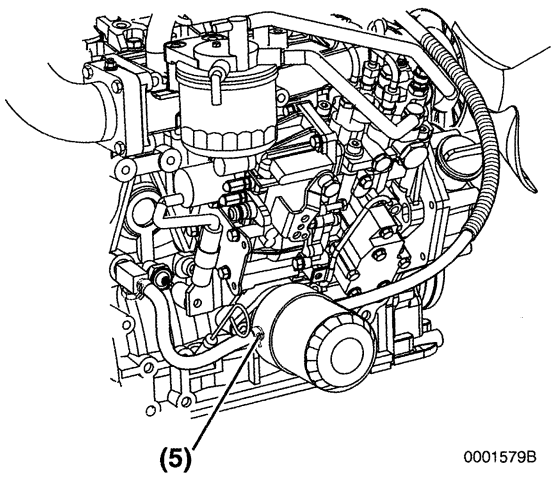


Figure 17

4. After draining the engine coolant, reinstall and tighten the radiator drain plug. Reinstall and tighten the engine block drain plug or connect the coolant hose at the oil cooler.
5. Fill radiator and engine with engine coolant. *See Filling Radiator With Engine Coolant on page 40.*

Adjust Intake / Exhaust Valve Clearance

Proper adjustment is necessary to maintain the correct timing for opening and closing the valves. Improper adjustment will cause the engine to run noisily, resulting in poor engine performance and engine damage. Consult your authorized Yanmar industrial engine dealer or distributor to adjust the intake / exhaust valve clearance.

Every 1500 Hours of Operation

Perform the following maintenance every 1500 hours of operation.

- **Inspect, Clean and Test Fuel Injectors**
- **Inspect and Clean Turbocharger (Blower Wash as Necessary) - 3TNV84T, 4TNV84T, 4TNV98T and 4TNV106T**

Inspect, Clean and Test Fuel Injectors

⚠ WARNING

HIGH PRESSURE HAZARD!

- **Avoid skin contact with high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray obtain prompt medical treatment.**
- **NEVER check for a fuel leak with your hands. ALWAYS use a piece of wood or cardboard. Have your authorized Yanmar industrial engine dealer or distributor repair the damage.**
- **Failure to comply could result in death or serious injury.**

Proper operation of the fuel injectors is required to obtain the optimum injection pattern for full engine performance. The EPA / ARB requires that you have the injectors inspected, cleaned and tested every 1500 hours. See your authorized Yanmar industrial engine dealer or distributor for this service.

Inspect and Clean Turbocharger (Blower Wash as Necessary) - 3TNV84T, 4TNV84T, 4TNV98T and 4TNV106T

Turbocharger service is required by the EPA / ARB every 1500 hours. Your authorized Yanmar industrial engine dealer or distributor will inspect, clean and blower wash the unit if necessary. If you notice that the engine seems sluggish or the exhaust color is abnormal NEVER wait until the next periodic interval. Have your authorized Yanmar industrial engine dealer or distributor service the turbocharger soon.

Every 2000 Hours of Operation

Perform the following maintenance every 2000 hours of operation.

- **Flush the Cooling System and Check the Cooling System Components**
- **Check and Replace Fuel Hoses and Engine Coolant Hoses**
- **Lap the Intake and Exhaust Valves**

Flush the Cooling System and Check the Cooling System Components

⚠ DANGER

SCALD HAZARD!

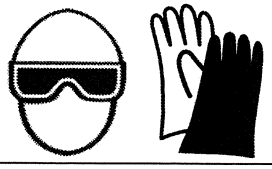
- **NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.**
- **Securely tighten the radiator cap after you check the radiator. Steam can spurt out during engine operation if the cap is loose.**
- **ALWAYS check the level of engine coolant by observing the reserve tank.**
- **Failure to comply will result in death or serious injury.**

⚠ WARNING

BURN HAZARD!

- **Wait until the engine cools before you drain the engine coolant. Hot engine coolant may splash and burn you.**
- **Failure to comply could result in death or serious injury.**

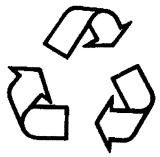
⚠ CAUTION



COOLANT HAZARD!

- **Wear eye protection and rubber gloves when you handle Long Life or Extended Life Engine Coolant. If contact with the eyes or skin should occur, wash with clean water.**
- **Failure to comply may result in minor or moderate injury.**

CAUTION



Be responsible to the environment. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.

- **Follow the guidelines of the EPA or other governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.**
- **NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**

Rust and water scale will accumulate in the cooling system after many hours of operation. This will lower the efficiency of the cooling system and damage the engine oil cooler deteriorating the engine oil. Consult your authorized Yanmar industrial engine dealer or distributor to flush the cooling system.

Check and Replace Fuel Hoses and Engine Coolant Hoses

Regularly check the fuel system and engine coolant system hoses. If they are cracked or degraded, replace them. Replace the hoses at least every two years. Consult your authorized Yanmar industrial engine dealer or distributor to replace fuel hoses and engine coolant system hoses.

Lap the Intake and Exhaust Valves

Adjustment is necessary to maintain proper contact of the valves and seats. Consult your authorized Yanmar industrial engine dealer or distributor to adjust valve seats.

TROUBLESHOOTING

If a problem occurs, stop the engine immediately. Refer to the SYMPTOM column in the Troubleshooting Chart to identify the problem.

CAUTION

If any indicator fails to illuminate when the key switch is in the ON position, see your authorized Yanmar industrial engine dealer or distributor for service before operating the engine.

CAUTION

If any indicator illuminates during engine operation stop the engine immediately. Determine the cause and repair the problem before you continue to operate the engine.

TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	ACTION	REFER TO
Indicator Turns On - Engine Running			
Engine oil pressure indicator	• Low level of engine oil • Too high an oil level	• Check and adjust oil level as necessary	*Checking Engine Oil on page 38*
	• Clogged engine oil filter	• Replace engine oil filter element	*Replace Engine Oil and Engine Oil Filter on page 73*

SYMPTOM	PROBABLE CAUSE	ACTION	REFER TO
Engine coolant indicator	• Low engine coolant level	• Add engine coolant	*Filling Radiator With Engine Coolant on page 40*
	• Dirty radiator fins	• Clean the radiator fins	*Check and Clean Radiator Fins on page 81*
	• Engine coolant leaking	• See authorized Yanmar industrial engine dealer or distributor	—
	• V-belt loose or damaged	• Adjust V-belt or replace	*Check and Adjust Cooling Fan V-belt on page 75*
	• Contaminated engine coolant	• See authorized Yanmar industrial engine dealer or distributor	—
	• Faulty engine coolant pump		—
Battery indicator	• V-belt loose or damaged	• Adjust V-belt or replace	*Check and Adjust Cooling Fan V-belt on page 75*
	• Battery failure	• Check battery condition	*Check Battery on page 78*
	• Faulty alternator	• See authorized Yanmar industrial engine dealer or distributor	—
Indicator Does Not Turn ON - Key Switch is Turned to ON (OFF → ON)			
	• Faulty electrical wiring or faulty indicator	• See authorized Yanmar industrial engine dealer or distributor	—
Indicator Stays On - Key Switch is Turned from Start to ON (START → ON)			
• Battery indicator stays ON	• Faulty alternator	• See authorized Yanmar industrial engine dealer or distributor	—
• Engine oil pressure indicator stays ON	• Faulty engine oil pressure switch		—
Engine Does Not Start			
• Starter motor operates but engine does not start	• No diesel fuel	• Refuel and prime fuel system	*Filling the Fuel Tank on page 34*
	• Air in fuel system	• Prime fuel system	*Priming The Fuel System on page 36*
	• Improper diesel fuel	• Replace with recommended diesel fuel	*Diesel Fuel Specifications on page 33*
	• Clogged fuel filter	• Replace fuel filter	*Replace Fuel Filter on page 84*
	• Poor fuel injection	• See authorized Yanmar industrial engine dealer or distributor	—
	• Compressed air leakage from intake / exhaust valves		—
	• Faulty engine stop solenoid		

SYMPTOM	PROBABLE CAUSE	ACTION	REFER TO
• Starter motor does not operate or rotates too slowly (engine can be turned manually)	• Battery needs charging	• Check electrolyte, recharge	*Check Battery on page 78*
	• Faulty cable connection at • battery terminals	• Clean terminals, retighten	—
	• Faulty starter switch	• See authorized Yanmar industrial engine dealer or distributor	—
	• Faulty starter motor		—
• Engine cannot be manually turned	• Inner parts seized or damaged		—
White or Black Exhaust Smoke			
• Black exhaust smoke	• Engine overloaded	• Reduce load	—
	• Clogged air cleaner element	• Clean element or replace	*Clean Air Cleaner Element on page 82*
	• Improper diesel fuel	• Replace with recommended diesel fuel	*Diesel Fuel Specifications on page 33*
	• Faulty spraying of fuel injection	• See authorized Yanmar industrial engine dealer or distributor	—
	• Excessive intake / exhaust valve clearance		—
• White exhaust smoke	• Improper diesel fuel	• Replace with recommended diesel fuel	*Diesel Fuel Specifications on page 33*
	• Faulty spray pattern of fuel injection	• See authorized Yanmar industrial engine dealer or distributor	—
	• Fuel injection timing delay		—
	• Engine burning oil		—

TROUBLESHOOTING INFORMATION

If your engine does not operate properly, refer to the troubleshooting chart or consult your authorized Yanmar industrial engine dealer or distributor.

Supply the authorized Yanmar industrial engine dealer or distributor with the following information:

- Model name and serial number of your engine
- The driven machine type (tractor, generator, skid steer loader), manufacturer's name, model and serial number
- How long the engine has been in service (the number of engine hours or the number of calendar months)
- Operating conditions when problem occurs:
  - Engine rpm
  - Color of exhaust smoke
  - Type of diesel fuel
  - Type of engine oil
  - Any abnormal noises or vibration
  - Operating environment such as high altitude or extreme ambient temperatures, etc.
- Engine maintenance history and previous problems
- Other factors that contribute to the problem

LONG TERM STORAGE

This section of the *Operation Manual* describes the procedures necessary to place the engine into long term storage (six months or longer) and how to place it back into operation.

BEFORE YOU PLACE THE ENGINE IN LONG TERM STORAGE

⚠ DANGER

EXPLOSION HAZARD!

- **NEVER check the remaining battery charge by shorting out the terminals. This will result in a spark and may cause an explosion or fire. Use a hydrometer to check the remaining battery charge.**
- **If the electrolyte is frozen, slowly warm the battery before you recharge it.**
- **Failure to comply will result in death or serious injury.**

⚠ WARNING

BURN HAZARD!

- **Batteries contain sulfuric acid. NEVER allow battery fluid to come in contact with clothing, skin or eyes. Severe burns could result. ALWAYS wear safety goggles and protective clothing when servicing the battery. If contact with the skin and / or eyes should occur, flush with a large amount of water and obtain prompt medical treatment.**
- **Failure to comply could result in death or serious injury.**

⚠ CAUTION

FLYING OBJECT HAZARD!

- **ALWAYS wear eye protection when servicing engine and when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.**
- **Failure to comply may result in minor or moderate injury.**

CAUTION

Protect the air cleaner, turbocharger (if equipped) and electric components from damage when you use steam or use high-pressure water to clean the engine.

1. Perform the next Preventive Maintenance procedure. For example, if there are 10 hours before the 250 hour maintenance, you should do the maintenance before you place the engine in storage. *See the Periodic Maintenance Schedule on page 71.*
2. Flush the radiator and refill with Long Life Engine Coolant. For engine coolant specifications *see Engine Coolant Specifications on page 39* and for the procedure for draining and refilling the cooling system see *Filling Radiator With Engine Coolant on page 40.*
3. Clean the exterior of the engine so it is free of grease and oil.
4. Drain the fuel tank or make sure it is completely full. *See Filling the Fuel Tank on page 34.*
5. Grease exposed parts of the engine speed control system.
6. Protect the air cleaner, muffler and electrical components (alternator, starter motor, switches) from water and dust.
7. Disconnect the negative (-) battery cable to prevent the battery from discharging.
8. Check the battery fluid and add distilled water as required.
9. Charge the battery once a month during storage.

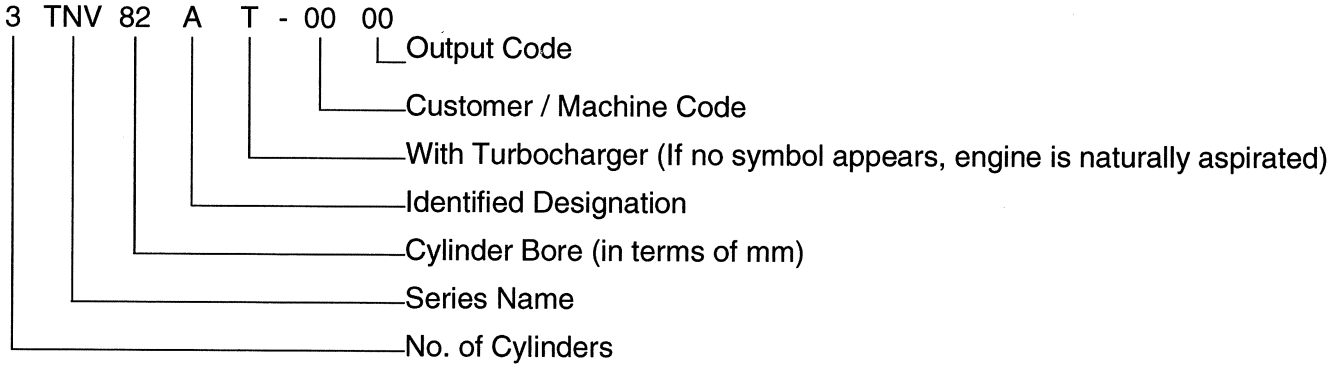
RETURNING THE ENGINE TO SERVICE

1. Perform the *Daily Checks on page 41.*
2. Prime the fuel system. *See Priming The Fuel System on page 36.*
3. Start the engine. Allow the engine to idle for approximately 15 minutes while you check for:
   - Proper oil pressure
   - Fuel, engine oil, or coolant leaks
   - Proper operation of the indicators and / or gauges.
4. Avoid prolonged operation at minimum or maximum engine speeds and loads for the remainder of the first hour of operation.

SPECIFICATIONS

GENERAL

Description of Model Number



Engine Speed Specifications

NOTATION	AVAILABLE ENGINE SPEED	INTENDED USES
VM	2000 ~ 3000 rpm (min^{-1})	Agricultural, Constructive, Industrial Machines
CL	1500 or 1800 rpm (min^{-1})	4-pole Generator Sets, Irrigation Pumps

VM: Variable Medium Speed
CL: Constant Low Speed

Engine General Specifications

Type	Vertical Inline, Water Cooled, 4-Cycle Diesel Engine
Combustion System	Direct Injection
Starting System	Electric Starting
Cooling System	Radiator
Lubricating System	Forced Lubrication With Trochoid Pump
PTO Position	Flywheel End
Direction of Rotation	Counterclockwise Viewed from Flywheel Side

Note:

1. The information described in *Principal Engine Specifications* is for a "standard" engine. To obtain the information for the engine installed in your driven machine, please refer to the manual provided by the driven machine manufacturer.
2. Engine rating conditions are as follows (SAE J1349, ISO 3046/1):
   - Atmospheric Condition: Room temperature 77°F (25°C), Atmospheric pressure 29.53 in Hg (100 kPa, 750mm Hg), Relative humidity 30%
   - Fuel Temperature at Fuel Injector Pump Inlet: 104°F (40°C)
   - With Cooling Fan, Air Cleaner, Muffler: Yanmar Standard
   - After Engine Break-In Period. Output Allowable Deviation: ± 3%
   - 1 PS = 0.7355 kW
   - 1 hp SAE (Society of Automotive Engineers) = 0.7457 kW

PRINCIPAL ENGINE SPECIFICATIONS

3TNV82A

Engine Model	3TNV82A								
Version	CL			VM					
Type	Vertical Inline Diesel Engine								
Combustion System	Direct Injection								
Aspiration	Natural								
No. of Cylinders	3								
Bore × Stroke	3.228 x 3.307 in (82 × 84 mm)								
Displacement	81.208 cu in (1.331 L)								
Continuous Rated Output	rpm (min^{-1})	1500	1800						
	hp SAE	13.3	16.1						
	kW	9.9	12.0						
	PS	13.5	16.3						
Max. Rated Output (Net)	rpm (min^{-1})	1500	1800	2000	2200	2400	2600	2800	3000
	hp SAE	14.7	17.7	19.6	21.5	23.5	25.4	27.4	29.4
	kW	11.0	13.2	14.6	16.0	17.5	19.0	20.4	21.9
	PS	14.9	17.9	19.9	21.8	23.8	25.8	27.8	29.8
High Idling	rpm (min^{-1})	1600 ± 25	1895 ± 25	2205 ± 25	2420 ± 25	2615 ± 25	2810 ± 25	2995 ± 25	3210 ± 25
Engine Weight (Dry) With Flywheel Housing*	304.3 lb (138 kg)			282.2 lb (128 kg)					
PTO Position	Flywheel Side								
Direction of Rotation	Counterclockwise Viewed From Flywheel Side								
Cooling System	Liquid-Cooled With Radiator								
Lubricating System	Forced Lubrication With Trochoid Pump								
Normal Oil Pressure									
Starting System	Electric Starting - Starter Motor: DC12V, 1.6 hp (1.2 kW)								
	Alternator: DC12V, 40A								
	Recommended Battery Capacity: 12V, 52 Amp-Hour (5h rating)								
Dimensions (L × W × H)*	21.77 x 19.25 x 22.24 in (553 × 489 × 565 mm)			20.79 x 9.25 x 22.24 in (528 x 489 x 565 mm)					
Engine Oil Pan Capacity**	5.8 / 3.8 qt (5.5 / 3.6 L) (Dipstick Upper Limit / Lower Limit)								
Engine Coolant Capacity	0.5 gal (1.8 L) Engine Only								
Standard Cooling Fan	13.19 in (335 mm) O/D, 6 Blades Pusher Type								

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

SPECIFICATIONS

3TNV84

Engine Model	3TNV84								
Version	CL			VM					
Type	Vertical Inline Diesel Engine								
Combustion System	Direct Injection								
Aspiration	Natural								
No. of Cylinders	3								
Bore × Stroke	3.307 x 3.543 in (84 x 90 mm)								
Displacement	91.275 cu in (1.496 L)								
Continuous Rated Output	rpm (min^{-1})	1500	1800						
	hp SAE	15.1	18.0						
	kW	11.3	13.5						
	PS	15.3	18.3						
Max. Rated Output (Net)	rpm (min^{-1})	1500	1800	2000	2200	2400	2600	2800	3000
	hp SAE	16.6	19.8	22.0	24.3	26.4	28.6	30.9	33.0
	kW	12.4	14.8	16.4	18.1	19.7	21.3	23.0	24.6
	PS	16.8	20.1	22.3	24.6	26.8	29.0	31.3	33.5
High Idling	rpm (min^{-1})	1600 ± 25	1895 ± 25	2205 ± 25	2420 ± 25	2615 ± 25	2810 ± 25	2995 ± 25	3210 ± 25
Engine Weight (Dry) With Flywheel Housing*	355.0 lb (161 kg)			341.8 lb (155 kg)					
PTO Position	Flywheel Side								
Direction of Rotation	Counterclockwise Viewed From Flywheel Side								
Cooling System	Liquid-Cooled With Radiator								
Lubricating System	Forced Lubrication With Trochoid Pump								
Normal Oil Pressure									
Starting System	Electric Starting - Starter Motor: DC12V, 1.6 hp (1.2 kW)								
	Alternator: DC12V, 40A								
	Recommended Battery Capacity: 12V, 60 Amp-Hour (5h rating)								
Dimensions (L × W × H)*	23.19 x 19.13 x 24.49 in (589 x 486 x 622 mm)			22.20 x 19.13 x 24.49 in (564 x 486 x 622 mm)					
Engine Oil Pan Capacity**	7.1 / 4.1 qt (6.7 / 3.9 L) (Dipstick Upper Limit / Lower Limit)								
Engine Coolant Capacity	0.5 gal (2.0 L) Engine Only								
Standard Cooling Fan	13.19 in (335 mm) O/D, 6 Blades Pusher Type								

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

3TNV84T

Engine Model	3TNV84T								
Version	CL			VM					
Type	Vertical Inline Diesel Engine								
Combustion System	Direct Injection								
Aspiration	Turbocharged								
No. of Cylinders	3								
Bore × Stroke	3.307 x 3.543 in (84 x 90 mm)								
Displacement	91.275 cu in (1.496 L)								
Continuous Rated Output	rpm (min^{-1})	1500	1800						
	hp SAE	18.7	22.2						
	kW	14.0	16.5						
	PS	19.0	22.5						
Max. Rated Output (Net)	rpm (min_{-1})	1500	1800	2000	2200	2400	2600	2800	3000
	hp SAE	21.2	25.2	28.1	30.6	33.5	36.0	39.0	41.4
	kW	15.8	18.8	21.0	22.8	25.0	26.8	29.1	30.9
	PS	21.5	25.5	28.5	31.0	34.0	36.5	39.5	42.0
High Idling	rpm (min^{-1})	1600 ± 25	1895 ± 25	2205 ± 25	2420 ± 25	2615 ± 25	2810 ± 25	2995 ± 25	3210 ± 25
Engine Weight (Dry) With Flywheel Housing*	355.0 lb (161 kg)			341.8 lb (155 kg)					
PTO Position	Flywheel Side								
Direction of Rotation	Counterclockwise Viewed From Flywheel Side								
Cooling System	Liquid-Cooled With Radiator								
Lubricating System	Forced Lubrication With Trochoid Pump								
Normal Oil Pressure									
Starting System	Electric Starting - Starter Motor: DC12 V, 1.6 hp (1.2 kW)								
	Alternator: DC12V, 40A								
	Recommended Battery Capacity: 12V, 60 Amp-Hour (5h rating)								
Dimensions (L × W × H)*	23.19 x 19.13 x 24.49 in (589 x 486 x 622 mm)			22.20 x 19.13 x 24.49 in (564 x 486 x 622 mm)					
Engine Oil Pan Capacity**	7.1 / 4.1 qt (6.7 / 3.9 L) (Dipstick Upper Limit / Lower Limit)								
Engine Coolant Capacity	0.5 gal (2.0 L) Engine Only								
Standard Cooling Fan	13.78 in (350 mm) O/D, 6 Blades Pusher Type								

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

SPECIFICATIONS

3TNV88

Engine Model	3TNV88								
Version	CL			VM					
Type	Vertical Inline Diesel Engine								
Combustion System	Direct Injection								
Aspiration	Natural								
No. of Cylinders	3								
Bore × Stroke	3.465 x 3.543 in (88 x 90 mm)								
Displacement	100.183 cu in (1.642 L)								
Continuous Rated Output	rpm (min^{-1})	1500	1800						
	hp SAE	16.5	19.8						
	kW	12.3	14.8						
	PS	16.7	20.1						
Max. Rated Output (Net)	rpm (min^{-1})	1500	1800	2000	2200	2400	2600	2800	3000
	hp SAE	18.1	21.8	24.2	26.6	29.0	31.5	33.7	36.3
	kW	13.5	16.3	18.0	19.9	21.6	23.5	25.2	27.1
	PS	18.4	22.1	24.5	27.0	29.4	31.9	34.2	36.8
High Idling	rpm (min^{-1})	1600 ± 25	1895 ± 25	2205 ± 25	2420 ± 25	2615 ± 25	2810 ± 25	2995 ± 25	3210 ± 25
Engine Weight (Dry) With Flywheel Housing*	355.0 lb (161 kg)			341.8 lb (155 kg)					
PTO Position	Flywheel Side								
Direction of Rotation	Counterclockwise Viewed From Flywheel Side								
Cooling System	Liquid-Cooled With Radiator								
Lubricating System	Forced Lubrication With Trochoid Pump								
Normal Oil Pressure									
Starting System	Electric Starting - Starter Motor: DC12V, 1.6 hp (1.2 kW)								
	Alternator: DC12V, 40A								
	Recommended Battery Capacity: 12V, 60 Amp-Hour (5h rating)								
Dimensions (L × W × H)*	23.19 x 19.13 x 24.49 in (589 x 486 x 622 mm)			22.20 x 19.13 x 24.49 in (564 x 486 x 622 mm)					
Engine Oil Pan Capacity**	7.1 / 4.1 qt (6.7 / 3.9 L) (Dipstick Upper Limit / Lower Limit)								
Engine Coolant Capacity	0.5 gal (2.0 L) Engine Only								
Standard Cooling Fan	13.19 in (335 mm) O/D, 6 Blades Pusher Type								

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

4TNV84

Engine Model	4TNV84								
Version	CL			VM					
Type	Vertical Inline Diesel Engine								
Combustion System	Direct Injection								
Aspiration	Natural								
No. of Cylinders	4								
Bore × Stroke	3.307 x 3.543 in (84 x 90 mm)								
Displacement	121.721 cu in (1.995 L)								
Continuous Rated Output	rpm (min^{-1})	1500	1800						
	hp SAE	20.0	23.8						
	kW	14.9	17.7						
	PS	20.3	24.1						
Max. Rated Output (Net)	rpm (min^{-1})	1500	1800	2000	2200	2400	2600	2800	3000
	hp SAE	22.0	26.1	29.4	32.4	35.3	38.2	41.1	44.1
	kW	16.4	19.5	21.9	24.1	26.3	28.5	30.7	32.9
	PS	22.3	26.5	29.8	32.8	35.8	38.7	41.7	44.7
High Idling	rpm (min^{-1})	1600 ± 25	1895 ± 25	2205 ± 25	2420 ± 25	2615 ± 25	2810 ± 25	2995 ± 25	3210 ± 25
Engine Weight (Dry) With Flywheel Housing*	403.5 lb (183 kg)			374.9 lb (170 kg)					
PTO Position	Flywheel Side								
Direction of Rotation	Counterclockwise Viewed From Flywheel Side								
Cooling System	Liquid-Cooled With Radiator								
Lubricating System	Forced Lubrication With Trochoid Pump								
Normal Oil Pressure									
Starting System	Electric Starting - Starter Motor: DC12V, 1.9 hp (1.4 kW)								
	Alternator: DC12V, 40A								
	Recommended Battery Capacity: 12V, 60 Amp-Hour (5h rating)								
Dimensions (L × W × H)*	26.89 x 19.63 x 24.29 in (683 x 498.5 x 617 mm)			25.91 x 19.63 x 24.29 in (658 x 498.5 x 617 mm)					
Engine Oil Pan Capacity**	7.8 / 4.2 qt (7.4 / 4.0 L) (Dipstick Upper Limit / Lower Limit)								
Engine Coolant Capacity	0.7 gal (2.7 L) Engine Only								
Standard Cooling Fan	14.57 in (370 mm) O/D, 6 Blades Pusher Type								

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

SPECIFICATIONS

4TNV84T

Engine Model	4TNV84T								
Version	CL			VM					
Type	Vertical Inline Diesel Engine								
Combustion System	Direct Injection								
Aspiration	Turbocharged								
No. of Cylinders	4								
Bore × Stroke	3.307 x 3.543 in (84 x 90 mm)								
Displacement	121.721 cu in (1.995 L)								
Continuous Rated Output	rpm (min^{-1})	1500	1800						
	hp SAE	25.6	32.5						
	kW	19.1	24.3						
	PS	26.0	33.0						
Max. Rated Output (Net)	rpm (min^{-1})	1500	1800	2000	2200	2400	2600	2800	3000
	hp SAE	28.6	36.0	37.5	41.0	44.9	47.8	51.8	55.2
	kW	21.3	26.9	27.9	30.5	33.5	35.7	38.6	41.2
	PS	29.0	36.5	38.0	41.5	45.5	48.5	52.5	56.0
High Idling	rpm (min^{-1})	1600 ± 25	1895 ± 25	2205 ± 25	2420 ± 25	2615 ± 25	2810 ± 25	2995 ± 25	3210 ± 25
Engine Weight (Dry) With Flywheel Housing*	403.5 lb (183 kg)			374.9 lb (170 kg)					
PTO Position	Flywheel Side								
Direction of Rotation	Counterclockwise Viewed From Flywheel Side								
Cooling System	Liquid-Cooled With Radiator								
Lubricating System	Forced Lubrication With Trochoid Pump								
Normal Oil Pressure									
Starting System	Electric Starting - Starter Motor: DC12V, 1.9 hp (1.4 kW)								
	Alternator: DC12V, 40A								
	Recommended Battery Capacity: 12V, 60 Amp-Hour (5h rating)								
Dimensions (L × W × H)*	26.89 x 19.63 x 28.07 in (683 x 498.5 x 713 mm)			25.55 x 19.63 x 28.07 in (649 x 498.5 x 713 mm)					
Engine Oil Pan Capacity**	7.8 / 4.2 qt (7.4 / 4.0 L) (Dipstick Upper Limit / Lower Limit)								
Engine Coolant Capacity	0.7 gal (2.7 L) Engine Only								
Standard Cooling Fan	14.57 in (370 mm) O/D, 6 Blades Pusher Type								

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

4TNV88

Engine Model	4TNV88								
Version	CL			VM					
Type	Vertical Inline Diesel Engine								
Combustion System	Direct Injection								
Aspiration	Natural								
No. of Cylinders	4								
Bore × Stroke	3.465 x 3.543 in (88 x 90 mm)								
Displacement	133.618 cu in (2.190 L)								
Continuous Rated Output	rpm (min^{-1})	1500	1800						
	hp SAE	22.0	26.3						
	kW	16.4	19.6						
	PS	22.3	26.7						
Max. Rated Output (Net)	rpm (min^{-1})	1500	1800	2000	2200	2400	2600	2800	3000
	hp SAE	24.2	29.0	32.3	35.5	38.7	41.9	45.2	47.4
	kW	18.0	21.6	24.1	26.5	28.8	31.3	33.7	35.4
	PS	24.5	29.4	32.7	36.0	39.2	42.5	45.8	48.1
High Idling	rpm (min^{-1})	1600 ± 25	1895 ± 25	2205 ± 25	2420 ± 25	2615 ± 25	2810 ± 25	2995 ± 25	3210 ± 25
Engine Weight (Dry) With Flywheel Housing*	403.5 lb (183 kg)			374.9 lb (170 kg)					
PTO Position	Flywheel Side								
Direction of Rotation	Counterclockwise Viewed From Flywheel Side								
Cooling System	Liquid-Cooled With Radiator								
Lubricating System	Forced Lubrication With Trochoid Pump								
Normal Oil Pressure									
Starting System	Electric Starting - Starter Motor: DC12V, 1.9 hp (1.4 kW)								
	Alternator: DC12V, 40A								
	Recommended Battery Capacity: 12V, 60 Amp-Hour (5h rating)								
Dimensions (L × W × H)*	26.89 x 19.63 x 24.33 in (683 x 498.5 x 618 mm)			25.91 x 19.63 x 24.33 in (658 x 498.5 x 618 mm)					
Engine Oil Pan Capacity**	7.8 / 4.2 qt (7.4 / 4.0 L) (Dipstick Upper Limit / Lower Limit)								
Engine Coolant Capacity	0.7 gal (2.7 L) Engine Only								
Standard Cooling Fan	14.57 in (370 mm) O/D, 6 Blades Pusher Type								

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

SPECIFICATIONS

4TNV94L

Engine Model	4TNV94L						
Version	CL			VM			
Type	Vertical Inline Diesel Engine						
Combustion System	Direct Injection						
Aspiration	Natural						
No. of Cylinders	4						
Bore × Stroke	3.701 x 4.331 in (94 x 110 mm)						
Displacement	186.333 cu in (3.054 L)						
Continuous Rated Output	rpm (min^{-1})	1500	1800				
	hp SAE	35.0	41.9				
	kW	26.1	31.3				
	PS	35.5	42.5				
Max. Rated Output (Net)	rpm (min^{-1})	1500	1800	2000	2200	2400	2500
	hp SAE	39.0	46.4	47.3	51.3	55.7	57.7
	kW	29.1	34.6	35.3	38.2	41.6	43.0
	PS	39.5	47.0	48.0	52.0	56.5	58.5
High Idling	rpm (min^{-1})	1600 ± 25	1895 ± 25	2205 ± 25	2420 ± 25	2615 ± 25	2725 ± 25
Engine Weight (Dry) With Flywheel Housing*	540.2 lb (245 kg)			518.2 lb (235 kg)			
PTO Position	Flywheel Side						
Direction of Rotation	Counterclockwise Viewed From Flywheel Side						
Cooling System	Liquid-Cooled With Radiator						
Lubricating System	Forced Lubrication With Trochoid Pump						
Normal Oil Pressure							
Starting System	Electric Starting - Starter Motor: DC12V, 3.1 hp (2.3 kW)						
	Alternator: DC12V, 40A						
	Recommended Battery Capacity: 12V, 64 Amp-Hour (5h rating)						
Dimensions (L × W × H)*	28.31 x 19.61 x 29.21 in (719 x 498 x 742 mm)						
Engine Oil Pan Capacity**	11.1 / 6.3 qt (10.5 / 6.0 L) (Dipstick Upper Limit / Lower Limit)						
Engine Coolant Capacity	1.1 gal (4.2 L) Engine Only						
Standard Cooling Fan	16.14 in (410 mm) O/D, 6 Blades Pusher Type						

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

4TNV98

Engine Model	4TNV98						
Version	CL			VM			
Type	Vertical Inline Diesel Engine						
Combustion System	Direct Injection						
Aspiration	Natural						
No. of Cylinders	4						
Bore × Stroke	3.858 x 4.331 in (98 x 110 mm)						
Displacement	202.502 cu in (3.319 L)						
Continuous Rated Output	rpm (min^{-1})	1500	1800				
	hp SAE	41.4	49.3				
	kW	30.9	36.8				
	PS	42.0	50.0				
Max. Rated Output (Net)	rpm (min^{-1})	1500	1800	2000	2200	2400	2500
	hp SAE	46.4	55.2	56.2	61.2	66.1	68.5
	kW	34.6	41.2	41.9	45.6	49.3	51.1
	PS	47.0	56.0	57.0	62.0	67.0	69.5
High Idling	rpm (min^{-1})	1600 ± 25	1895 ±25	2205 ± 25	2420 ± 25	2615 ± 25	2725 ± 25
Engine Weight (Dry) With Flywheel Housing*	546.8 lb (248 kg)			518.2 lb (235 kg)			
PTO Position	Flywheel Side						
Direction of Rotation	Counterclockwise Viewed From Flywheel Side						
Cooling System	Liquid-Cooled With Radiator						
Lubricating System	Forced Lubrication With Trochoid Pump						
Normal Oil Pressure							
Starting System	Electric Starting - Starter Motor: DC12V, 3.1 hp (2.3 kW)						
	Alternator: DC12V, 40A						
	Recommended Battery Capacity: 12V, 64 Amp-Hour (5h rating)						
Dimensions (L × W × H)*	28.31 x 19.61 x 29.21 in (719 x 498 x 742 mm)						
Engine Oil Pan Capacity**	11.1 / 6.3 qt (10.5 / 6.0 L) (Dipstick Upper Limit / Lower Limit)						
Engine Coolant Capacity	1.1 gal (4.2 L) Engine Only						
Standard Cooling Fan	16.14 in (410 mm) O/D, 6 Blades Pusher Type						

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

SPECIFICATIONS

4TNV98T

Engine Model	4TNV98T						
Version	CL			VM			
Type	Vertical Inline Diesel Engine						
Combustion System	Direct Injection						
Aspiration	Turbocharged						
No. of Cylinders	4						
Bore × Stroke	3.858 x 4.331 in (98 x 110 mm)						
Displacement	202.502 cu in (3.319 L)						
Continuous Rated Output	rpm (min^{-1})	1500	1800				
	hp SAE	50.8	61.2				
	kW	37.9	45.6				
	PS	51.5	62.0				
Max. Rated Output (Net)	rpm (min^{-1})	1500	1800	2000	2200	2400	2500
	hp SAE	56.2	67.6	68.1	74.5	80.9	83.8
	kW	41.9	50.4	50.7	55.5	60.3	62.5
	PS	57.0	68.5	69.0	75.5	82.0	85.0
High Idling	rpm (min^{-1})	1600 ± 25	1895 ± 25	2205 ± 25	2420 ± 25	2615 ± 25	2725 ± 25
Engine Weight (Dry) With Flywheel Housing*	568.9 lb (258 kg)			540.2 lb (245 kg)			
PTO Position	Flywheel Side						
Direction of Rotation	Counterclockwise Viewed From Flywheel Side						
Cooling System	Liquid-Cooled With Radiator						
Lubricating System	Forced Lubrication With Trochoid Pump						
Normal Oil Pressure							
Starting System	Electric Starting - Starter Motor: DC12V, 3.1 hp (2.3 kW)						
	Alternator: DC12V, 40A						
	Recommended Battery Capacity: 12V, 64 Amp-Hour (5h rating)						
Dimensions (L × W × H)*	28.31 x 22.64 x 31.65 in (719 x 575 x 804 mm)						
Engine Oil Pan Capacity**	11.1 / 6.3 qt (10.5 / 6.0 L) (Dipstick Upper Limit / Lower limit)						
Engine Coolant Capacity	1.1 gal (4.2 L) Engine Only						
Standard Cooling Fan	16.93 in (430 mm) O/D, 8 Blades Suction Type						

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

4TNV106

Engine Model	4TNV106						
Version	CL			VM			
Type	Vertical Inline Diesel Engine						
Combustion System	Direct Injection						
Aspiration	Natural						
No. of Cylinders	4						
Bore × Stroke	4.173 x 4.921 in (106 x 125 mm)						
Displacement	269.189 cu in (4.412 L)						
Continuous Rated Output	rpm (min^{-1})	1500	1800				
	hp SAE	55.2	66.1				
	kW	41.2	49.3				
	PS	56.0	67.0				
Max. Rated Output (Net)	rpm (min^{-1})	1500	1800	2000	2200	2400	2500
	hp SAE	61.2	73.0	76.0	82.4	87.8	90.7
	kW	45.6	54.4	56.6	61.4	65.5	67.7
	PS	62.0	74.0	77.0	83.5	89.0	92.0
High Idling	rpm (min^{-1})	1600 ± 25	1895 ± 25	2205 ± 25	2420 ± 25	2615 ± 25	2725 ± 25
Engine Weight (Dry) With Flywheel Housing*	727.7 lb (330 kg)						
PTO Position	Flywheel Side						
Direction of Rotation	Counterclockwise Viewed From Flywheel Side						
Cooling System	Liquid-Cooled With Radiator						
Lubricating System	Forced Lubrication With Trochoid Pump						
Normal Oil Pressure							
Starting System	Electric Starting - Starter Motor: DC12V, 4.0 hp (3.0 kW)						
	Alternator: DC12V, 55A						
	Recommended Battery Capacity: 12V, 88 Amp-Hour (5h rating)						
Dimensions (L × W × H)*	31.81 x 24.69 x 31.61 in (808 x 627 x 803 mm)			30.63 x 24.69 x 31.61 in (778 x 627 x 803 mm)			
Engine Oil Pan Capacity**	14.8 / 5.3 qt (14.0 / 5.0 L) (Dipstick Upper Limit / Lower Limit)			14.8 / 6.9 qt (14.0 / 6.5 L) (Dipstick Upper Limit / Lower Limit)			
Engine Coolant Capacity	1.6 gal (6 L) Engine Only						
Standard Cooling Fan	19.68 in (500 mm) O/D 7 Blades Pusher Type			19.68 in (500 mm) O/D 7 blades suction type			

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

SPECIFICATIONS

4TNV106T

Engine Model	4TNV106T				
Version	CL			VM	
Type	Vertical Inline Diesel Engine				
Combustion System	Direct Injection				
Aspiration	Turbocharged				
No. of Cylinders	4				
Bore × Stroke	4.173 x 4.921 in (106 x 125 mm)				
Displacement	269.189 cu in (4.412 L)				
Continuous Rated Output	rpm (min^{-1})	1500	1800		
	hp SAE	69.0	82.8		
	kW	51.5	61.8		
	PS	70.0	84.0		
Max. Rated Output (Net)	rpm (min^{-1})	1500	1800	2000	2200
	hp SAE	76.1	91.2	93.7	96.6
	kW	56.8	68.0	69.9	72.0
	PS	77.2	92.5	95.0	97.9
High Idling	rpm (min^{-1})	1600 ± 25	1875 ± 25	2205 ± 25	2420 ± 25
Engine Weight (dry) With Flywheel Housing*	749.7 lb (340 kg)				
PTO Position	Flywheel Side				
Direction of Rotation	Counter-clockwise Viewed From Flywheel Side				
Cooling System	Liquid-Cooled With Radiator				
Lubricating System	Forced Lubrication With Trochoid Pump				
Normal Oil Pressure					
Starting System	Electric Starting - Starter Motor: DC12V, 4.0 hp (3.0 kW)				
	Alternator: DC12V, 55A				
	Recommended Battery Capacity: 12V, 88 Amp-Hour (5h rating)				
Dimensions (L × W × H)*	31.81 x 24.76 x 34.09 in (808 x 629 x 866 mm)			30.63 x 24.76 x 34.09 in (778 x 629 x 866 mm)	
Engine Oil Pan Capacity**	14.8 / 5.3 qt (14.0 / 5.0 L) (Dipstick Upper Limit / Lower Limit)			14.8 / 6.9 qt (14.0 / 6.5 L) (Dipstick Upper Limit / Lower Limit)	
Engine Coolant Capacity	1.6 gal (6 L) Engine Only				
Standard Cooling Fan	19.68 in (500 mm) O/D 7 Blades Pusher Type			19.68 in (500 mm) O/D, 7 Blades Suction Type	

* Engine Specifications Without Radiator

** Engine oil capacity for a "Deep Standard" oil pan. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.